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Tin-Ore Dressing at Llallagua, Bolivia--I

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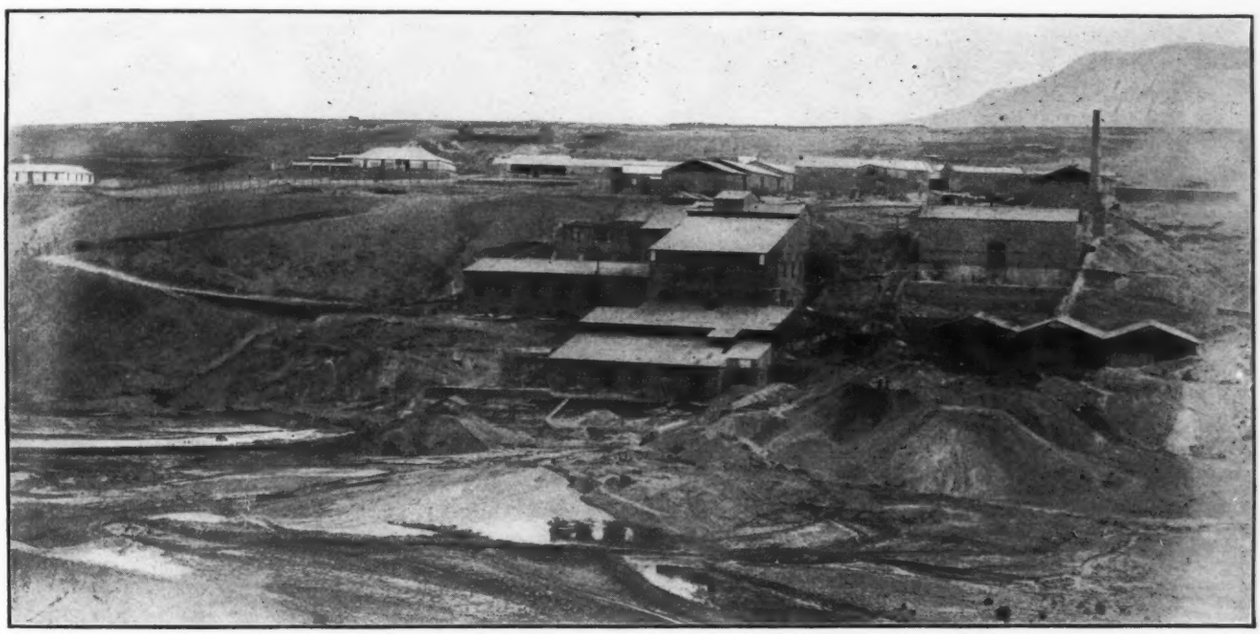
SYNOPSIS—Both oxidized and sulphide ores at Llallagua are concentrated on jigs and tables; pyritic middlings are roasted and separated magnetically, the magnetic material being reground and concentrated on tables. The tin occurs as cassiterite in both classes of ores. Operating conditions are expensive on account of high transport charges.

When we were about to leave the United States in 1913 to enter the employ of the Compañia Estañifera de Llallagua, we made some small search of the literature on the subject of Bolivia to find out what conditions—technical, social, climatic and otherwise—we might expect to encounter. Literature we found, and undoubtedly there exists much more than we discovered. There were books on travel, starting at Panama and ending at Patagonia, which told us we might expect to be afflicted with badly bumping hearts when we arrived at the high tableland of Bolivia. There were articles on mining and mining equipment, and on milling with pictures of Indians turning a pestle on a stone platform, giving us an illustration of the industry as practiced shortly after the time of Adam.

Having since seen the place from which about one-half of Bolivia's tin comes, we have wondered at the experiences of those whose writings we found. The altitude (about 13,000 ft.) caused us little if any trouble, and among our acquaintances few have been affected. Of course the height above the sea is a convenient and ever-present factor to shoulder the blame for the ill effects of too much food or liquor, two things commonly given every opportunity to do their work by those who come to Bolivia from sea-level locations. The climate at Llallagua we have found to be much better than that of either New England or the Middle West. Having had no experience with the climate of California, the writers can make no sweeping statements comparing the part of Bolivia we know with that of the United States as a whole.



THE CONCENTRATING PLANT AT LLALLAGUA, BOLIVIA

The high tableland of Bolivia is within the tropics. At Llallagua from December to May, there are heavy rains, but it does not rain all of the time during these months. During the remainder of the year there is little

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rain. The season without rains has cold nights, that is, cold enough for ice to form, say—5° C. There are strong winds, particularly during parts of July, August and September. These winds do not blow the whole day but for a few hours only and are, of course, most forcibly felt on the pampas or plains. Through the dry season the days at Llallagua are really delightful—plenty of sun, dry and comfortable. We found that the mines at Llallagua (and at Uncia) possess fairly good equipment, and the mills are not many years behind the times. The Llallagua company has three compressors, about a hundred air drills (half of which are normally in daily use), electric haulage and so on.

Llallagua District Produces One-Half of Bolivia's Tin

It is because we had gained from the available literature an impression so contrary to our experiences that we decided to write this article. We realize that conditions elsewhere in a mountainous country like Bolivia may be quite different from those obtaining at Llallagua, this being particularly true of the climate. Most certainly, also, the tin ores of other parts may be and undoubtedly in some cases are, similar to Llallagua's only in the fact that they contain tin. However, here is produced about one-half of Bolivia's total output of tin, so perhaps the operating conditions are as important as any others when quantity is considered.

The Compañia Estañifera de Llallagua is owned by a group of influential capitalists in Chile. Señor Don Orlando Ghigliotto S. is the general manager, resident in Santiago, Chile, and E. Diaz is resident manager at Llallagua. The property was purchased in 1906 and the present company was capitalized for £425,000, shares having a par value of £1 each. The shares have at times increased greatly in value, being quoted as high as 140 Chilean pesos (about £6). The company has paid in dividends about £600,000, has built from earnings a hydroelectric power plant which will shortly give 800 hp., has installed modern mining and milling equipment, has erected a Deutz motor and Diesel engine plant of 800 hp., and has at present a considerable reserve fund.

The mine of this company and the mines of Simon I. Patiño, at Uncia, are in the same mountain, working the same veins, and are at this writing producing about the same amount of ore. The Llallagua company's production is steadily increasing. In the last few years there has been much litigation between the two companies over disputed territory, but differences have been settled and a definite division line established. The importance of the Llallagua company may be judged from the fact that the yearly production of 8000 tons of *barrilla* (tin concentrates) or 5600 tons of fine tin is about 5% of the world's production, and more than 20% of Bolivia's production. The mines of Señor Patiño, at Uncia, are giving more than 25% of Bolivia's tin. Therefore, from the same mountain and really from veins within an area of a few meters comes about one-half of Bolivia's total output of tin.

Both Oxidized and Sulphide Ores

The ores are, for milling purposes, divided into two classes, the oxidized ores known locally as *pacos* and coming from parts of the mine where surface waters have had good opportunity to flow, and unoxidized ores, *piritas*, which are found in the parts of the mine where surface waters carrying oxygen have had little chance to circulate. The *piritas* material, as the name implies, always contains a great deal of pyrite and other sulphides. It is true, of course, that the *pacos* ores are found usually relatively near the surface while the *piritas* material is obtained from deeper levels, but this is not always the case. The veins or even different parts of the same vein do not offer anything like equal opportunity for waters to circulate without being robbed of their dissolved oxygen. In some of the veins there is at the same level a sharp dividing line between the *piritas* and the *pacos*. In other veins thoroughly oxidized *pacos* are found lower than *piritas* existing in the same vein in unoxidized condition.

The water-concentration section of the mill treats both classes of materials in the same way. The *barrilla* obtained from the *pacos* is called "black tin" and some buyers prefer

CASSITERITE VEIN IN CANCANIRI TUNNEL AT LLALLAGUA, BOLIVIA

it. From the *piritas* ore the *barrilla* obtained is sold under the mark "S.S." to show that it comes from the milling of sulphide ores. It is true that although the *barrilla* obtained from *piritas* is as rich in tin as that from *pacos* ores, still the sulphide *barrilla* contains a little more sulphur and more of metallic impurities than does the *pacos* or black-tin concentrates.

The mineralogical composition of the ores, particularly the *piritas,* is exceedingly complex. The tin always exists as the mineral, cassiterite, no stannite having ever been found at Llallagua. Our cassiterite is black and has a specific gravity of 6.9; the mineralogies give the specific gravity at 6.8 to 7.1. In Llallagua ores, even the

crystallized cassiterite contains small amounts of sulphur and iron, probably pyrite between the planes of the tin crystals. Besides the tin mineral, there occurs in the ore almost everything that one might hope to find. There is always much pyrite; in fact, some of the best ores contain as much as 20% sulphur. Arsenopyrite occurs in large amounts in some veins and is absent in others. Bismuthinite is found in small quantities in nearly all of the pyritic ores. The appearance of the ore when broken, particularly in the case of the very rich material, say, more than 65% tin, would indicate large bismuth percentages, but the assays seldom show any large quantities. This is explained by the fact that the ore seems to break so as to expose to good view the long bismuthinite crystals, and on such ores as those at Llallagua an assay is absolutely necessary in order to form any definite idea of the bismuth content. Such assay is always disappointing. Wolfram, or rather scheelite, is found in all of the veins but not in paying quantities. Native copper occurs in some of the ores, but the occurrence is usually local and the amount of copper in the total is small. Quartz is common and is frequently well crystallized. Then, of course, there are the igneous rock and the slate.

As far as the mill is concerned we are interested in those minerals which are close to cassiterite in gravity. Bismuthinite has a gravity of 6.4, scheelite 6.0 and arsenopyrite 6.0. The bismuth and tungsten minerals occur in such small quantities that they cause us no trouble. Our *barrilla* never contains over 0.5% bismuth. There is not at present enough of the bismuth or tungsten minerals to pay us for their recovery. In the cases where arsenopyrite occurs—and sometimes it comes in large amounts—it is impossible to keep this mineral out of the *barrilla*. However, only small sections of the mine are rich in the arsenical pyrite, or *pirita blanca* as the natives call it, and it is easy to mix the ores so as to keep the percentage of arsenic below 0.5 in the tin concentrates. In case of necessity the ore can be roasted and the arsenic volatilized.

The veins vary greatly in width and in richness. At Llallagua at present there are 15 known veins and more will undoubtedly be found. At times the width of the various veins may be only an inch or two, or in fact may disappear entirely, while again there may be a face of 60% ore more than 1 m. wide and this width and grade may persist for many meters in depth and length. As yet there has been no diminution of tin with depth. A vein, rich near the surface, may grow poor with increase of depth and then rich again at greater distance from the surface. It is not necessary that a vein outcrop. One of the best orebodies in the Llallagua mine at present, a vein nearly 1 m. wide and averaging as mined more than 25% tin, does not so far as we can determine appear at or near the surface. At a depth of 300 m. beneath the surface the ore is as good as or even better than that higher up. Naturally, the tin cannot go down forever, but at 300 m. it still exists undiminished in quantity and quality. In crosscut driving it is not at all uncommon to strike unexpectedly a body of ore of considerable size and richness. The whole mountain seems to be mineralized with veins both in the igneous rock and in the slate. It is true that those bodies of ore existing with igneous material are always more persistent, larger and richer; however, it is a fact that a vein may continue from the igneous into the slate and retain for a few meters its size and richness.

The vein matter and whatever country rock it is necessary to break with it are brought to the surface and then carefully hand-picked by women. Wherever possible the coarsely crystalline cassiterite is cobbed out and sacked ready for the market. This coarsely crystalline material, ready to ship without milling, is locally called *guia* and contains about 65% tin. Some of the veins are for many meters nearly solid *guia* and production in such cases is cheap. The waste rock is rejected and the remaining material containing the relatively finely divided cassiterite is sent 5 km. by aërial tramway to the mill. At Llallagua about 2½ tons of material is mined and brought to the surface for every ton the mill receives. This is in part due to the large amount of preparatory work now being done. Of the present tin production about 5% comes from the *guia* which is hand-picked at the mine.

The mill of the company has at present a single section with a capacity of about 200 tons per 24 hr. When the mill was first built the company was mining *pacos* ores

PRIMITIVE CONCENTRATION AND TRANSPORTATION AT LLALLAGUA

Concentration on the rectangular buddle following hand roasting has been superseded by mechanical devices; jig and table concentration is now followed by roasting in Kauffman furnaces and concentration in Stern magnetic separators. Llama transportation is still used, as Llallagua has no railroad; packages heavier than 100 lb. must be transported over the cart road.

only and the mill was designed to meet the conditions necessary in treating this oxidized, relatively soft, pyrite-free material. At present not more than 15% of the ores which arrive at the mill are of the *pacos* class, the remainder being *piritas*. For both classes of ores it is necessary to break the material so that all will pass a 10-mm. hole before sufficient of the cassiterite is broken free to make a start in the concentration. The mill is arranged on the graded-crushing, trommel-sizing, Hartz jig plan. Trommels are used to size the ore down to 1.5 mm. when the work is taken up by hydraulic classifiers, followed by settling boxes. Jigs are used to handle all the material above about 0.75 mm. in diameter. The ore finer than 0.75 mm. goes, after classification in Janney classifiers and thickening tanks, to Overstrom tables and Isbell vanners. The middlings and tailings from all jigs treating materials greater than 1.5 mm. in diameter are sent to Huntington and chilean mills. There is being installed at present a 6-ft. Hardinge pebble mill to regrind the coarse middlings and tailings. All jig tailings finer than 1.5 mm. enter the Janney classifiers and are re-treated on the tables. The reason jigs are used to treat material as small as 0.75 mm. is that heretofore there has not been sufficient table and vanner surface. New tables and vanners are now on the ground and in the future the fine material will all go directly to tables with the resultant saving in power, water, and attendance.

Cassiterite the Only Profitable Mineral

The only mineral in the ores that will pay for saving is the cassiterite. With the *pacos* ores there occur no minerals which approach closely in gravity the cassiterite. It is true that the oxidized ores contain much iron oxide, but this oxide is hydrated and porous and therefore relatively light. There is, then, no difficulty with a reasonably good classification in making a clean separation of the cassiterite from the other minerals which accompany it in the *pacos* ores. As in other classes of mills there is, of course, difficulty in saving the fine mineral. The tin ore at Llallagua does not slime badly.

With the pyritic ores the conditions for separation are not so easy. There exists in these unoxidized ores some minerals like arsenopyrite, bismuthinite and scheelite, which are too close to cassiterite in gravity to permit a clean water separation. As before explained the above minerals are not usually present in amounts sufficient to interfere with the grade of the *barrilla*. Pyrite is always present in large amounts. Between the pyrite and the cassiterite there is a gravity difference of two, enough for a clean separation of the two minerals, provided always that classification is good. This is as great a gravity difference as, or even greater than, that between the blende and the dolomitic limestone of the Joplin district of Missouri. So long as the material is relatively coarse there is no difficulty whatever in making a good classification and a *barrilla* free from impurities. "Free from impurities" always means here free from pyrite or, as they say, sulphur. Penalties, and these seem excessive, are imposed (but not always collected) by the European smelters in case the sulphur content of the *barrilla* is high. One form of contract with which the Llallagua company has had experience allows 1% of sulphur without penalty. If over 1% and up to 3%, ½% of tin is deducted for each unit of sulphur, and if over 3% sulphur is present in the *barrilla* the buyer has the privilege of rejecting the lot.

Hand Roasting Too Expensive

As the material grows finer there is difficulty in making at the same time a good tin recovery and a *barrilla* free from pyrite. This is perhaps due to poor classification, but it should be remembered that the amount of sulphur allowable is not large. With the pyrite ores, there was therefore the problem of treating fine-grained pyrite-cassiterite middlings. At first the company installed hand calcining furnaces in which the middlings were dead-roasted as a preliminary to washing on buddles. The only fuel available here for use in roasting is the dung of the llama, this combustible being known as *taquia*. In appearance at least *taquia* is similar to sheep dung. It can be imagined that roasting in hand furnaces with sheep dung costing $10 per ton is a fairly expensive operation. It is not possible to obtain in the firebox of a roasting furnace with this fuel a sufficiently long flame, so the greater part of the fuel is mixed with the ore on the hearth of the furnace. The firebox is used to aid in keeping the mixed ore and fuel up to the ignition temperature. To give air for burning the mixture of dung and pyrite middlings, the working doors of the hearth must be open most of the time. Operating with material all of which will pass 1 mm., a hand furnace 20 ft. long and 10 ft. wide will roast about 4 tons from 30% sulphur to 2% sulphur per 24 hr. The fuel needed (*taquia*) will be about three quintals per ton (1 quintal = 101 lb.). The labor cost is about $1 per ton in addition to the fuel.

The calcined material from the hand furnaces was concentrated in buddles. In these buddles the concentration is primarily a sizing operation. The cassiterite is finer than the pyrite and during the calcination the iron mineral, in changing to oxide, swells. It is true that the particles of iron oxide or gangue will be carried farther down the plane of the buddle than particles of cassiterite of the same diameter. If, however, there exists a great number of small particles of gangue and iron oxide with the cassiterite, concentration in a *tina* or tub is used to keep this material out of the *barrilla*. The ore is fed with an amount of water depending upon its fineness (the finer the less water), and the bed is continually swept to keep an even depositing plane. When the buddle has filled, the bed is marked off by the chief of the section (the *mayordomo*) into concentrates, middlings, and tailings, the concentrates consisting of grains of the finest diameter, the middlings being coarser, and the tailings containing the grains of greatest diameter. Each division is shoveled from the buddle and rewashed until the concentrates are rich enough in tin to be called *barrilla*, and the tailings so poor that they can be sent to the river. The *barrilla* obtained in this manner averages 68% tin and is low in sulphur.

(*To be continued*)

First National Copper

After being shut down for several years on account of complications with the farmers over smeltery fumes, the First National Copper, according to the *Boston News Bureau*, has apparently abandoned the idea of installing devices for the prevention of the emission of these obnoxious fumes. A contract is reported to have been made

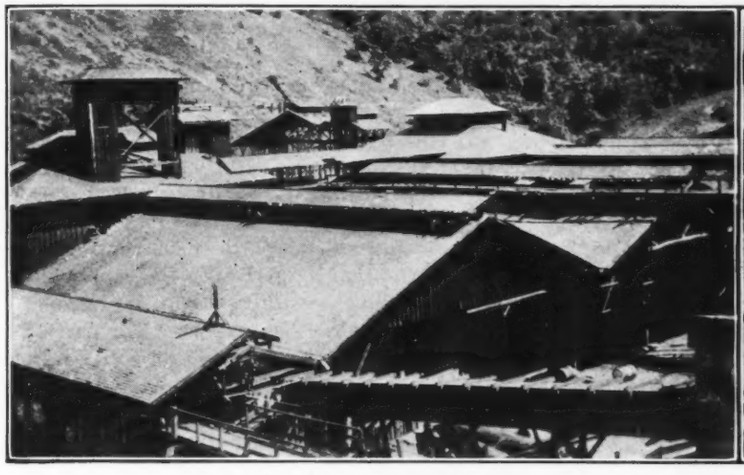
with the Mammoth Copper Mining Co., whereby the First National ores will be treated at Kennett, Calif. The Mammoth company will take ore in addition to the 250 tons per day contracted for as fast as the mining company can get its production to a higher basis. This will enable the First National to get in on the present high copper market.

New Almaden Quicksilver Mine

By Richard G. Place*

New Almaden is situated in Santa Clara County, California, about 12 mi. south of the city of San Jose. There is a branch line of the Southern Pacific R.R. running between San Jose and the mines. Instead of rugged mountains that usually surround a mine, the approach is through a beautiful fertile valley of spreading fields and orchards. New Almaden is the largest mercury mine in California and was for a number of years the second largest producer in the world, Almaden of Spain being the premier quicksilver producer.

The main shaft is on the top of a hill, extending down for over 2,000 ft. There is a continuous orebody occurring between layers of serpentine and shale for nearly four-fifths of this distance. Parallel to the orebody is a rhyolite dike. The country rock is sandstone and shattered greenstone.



Retorting and condensing plant

Washing old mine-filling in a rocker

VIEWS AT THE NEW ALMADEN QUICKSILVER MINE IN SANTA CLARA COUNTY, CALIFORNIA

From the shaft the ore is taken by two cable inclines, that convey it to the retorts at the bottom of the hill. A part of the cinnabar ore is screened, but the majority is fine enough, when it comes from the mine, to be introduced directly into the retorts. Both the retorts and the condensers are of an antiquated type and leak so badly that all the workmen suffer more or less from salivation.

At present considerable profit is being realized by washing the sand and dirt taken from under old parts of the workings that are being remodeled. The washing is done in a rocker such as was used in the early placer mines in this country. The accompanying illustration shows one in operation at New Almaden. So far this year the production has been over 200 flasks per month. The present operators have a lease on the property for 25 years.

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What Excessive Gold Supply May Do

The National City Bank in its September circular points out in a lucid way what may result from an excessive importation of gold into the United States. In part it says the following:

The Allies still have large holdings of gold. The appeal to the French to exchange their holdings of coin for paper money has brought in over $100,000,000 since May 27, and a similar request lately by the British government has resulted in a noticeable increase in reserve of the Bank of England. Notwithstanding increased liabilities due to the big loan, the reserve now stands at 24%, compared with 16% a month ago. However, these gains are small compared with payments to be made here. Moreover, continued importation of gold is a menace to orderly progress of business in this country. So long as the fabric of credits is not enlarged, additions to gold reserves will do no harm, and serve to broaden the base under the situation; but bank credit is so readily available for a thousand inviting purposes that it is too much to expect of the people that they will abstain from using it for long at a time. They have never persisted in such self-restraint, and bankers have never been proof against their persuasions. There is no money trust strong enough to close the vaults against the public when it is in earnest about wanting accommodations.

There is a normal status, or equilibrium, between countries of the world, in industry, in gold holdings, and in all relations with each other. That status is not fixed, but cannot be changed violently without reaction. It is being changed now, and the prudent man will beware of the reaction. The United States is obtaining more than its share of the world's gold, as gold would be distributed under ordinary conditions, and when the war is over it will not be able to hold the excess. If new supplies have been stored away, unused and unpledged, and can be released without disturbance, well and good; we will have simply lost the interest on their value, and played the part of miser. But if we proceed to build credits on the new store, those credits will have to be liquidated when the base is removed, and liquidation of credits under such conditions is a painful experience. Moreover, the very use of these credits will have effect of expelling the base that supports them, as soon as normal trading conditions are restored. For if under temporary protection and stimulus afforded by the war, our industries are expanded on basis of higher wages and costs, we will be driven out of every foreign market as soon as the war is over, and lose no small share of our home trade also, with the result that the trade balances will turn heavily against us.

It is impossible to use additional credit made available by further increase in gold reserves without raising costs and prices in this country; for it can only be used by extensive borrowing and buying, with inauguration of enterprises which would create a competitive demand for labor at a time when supply of labor is limited; and however desirable it may be to have wages rise by natural progress, nothing will be

gained from a spasmodic movement which ends in loss of markets, widespread unemployment and prolonged stagnation. Wages can only be sustained and advanced by a steady demand for products of industries, and this cannot be had if our economic relations with the rest of the world are ignored and heedlessly thrown out of gear. The war is not going to last long enough for us to get far on a career planned only for war conditions.

We should not be alarmed over advent of prosperity because it is likely to end in trouble, but an expansion of indebtedness based on conditions so plainly temporary would be extremely shortsighted. Present bank reserves are more than sufficient to handle any safe degree of expansion and it will be better that the country does not receive additional capital in gold. Whatever is coming to us under these extraordinary trade conditions had better be taken in interest-bearing securities or dividend-paying shares of ownership in going properties, at home or abroad.

Miocene Age of Dodge Gypsum

By Charles R. Keyes*

From a strictly mining angle, it usually matters little what happens to be the geologic age of a mineral deposit. The subject only assumes business interest when the age determination extends the probable volume of available deposits, or points the way to the discovery of new bodies. Just such features are among the important results of recent investigations of the gypsum deposits in Iowa.

The geologic age of the Fort Dodge gypsum beds, which are among the most valuable in the United States, has been long a moot point. Reasoning from lithologic analogy of the Kansas deposits, late deductions have been in favor of a Permian, or Late Carboniferous age. That this inference is incorrect is shown by more recent observations.

The geologic structure of the Iowa gypsum beds, as recently made out, has important economic bearings. In this regard the most remarkable feature is the profound faulting that has taken place in the area. A large block of the gypsum six to eight miles in width has dropped down below the level of the upland plain of the region, and has thus escaped destruction by glacial planation and general stream-corrosion. Since the line of the fault is traceable for a distance of nearly 100 mi. the possible volume of available gypsum is extended far beyond that now opened up.

The determination beyond peradventure of the geologic age of the Iowa gypsum deposits—that the date of its origin is not Carboniferous, Permian, Triassic, nor even Cretaceous, as has been repeatedly urged at different times, but that it is Miocene, or mid-Tertiary—has deep significance. It places the gypsum and associated pink shales among true continental deposits—accumulations on dry land and wholly independent of sea, lake or even running water. It points out the possible occurrence, beneath the deep glacial drift of the state of Iowa, of other incoherent deposits which are not to be classed with the till at all but with the older Tertiary formations.

Since this possibility has been pointed out, evidences of the existence of the pink shales which are inseparably connected with the gypsum have been sought in other parts of the state. As a result these pink shales have been found in a number of places. Whether or not workable beds of gypsum are really associated with them in all cases remains yet to be determined by careful drilling. It seems probable that new fields of gypsum will be discovered.

Inasmuch as the key to the puzzle has at last been found, a large number of deposits that were formerly classed, without much critical scrutiny, with the glacial till have been found to be of earlier formation, and have been determined as Tertiary depositions. It also appears very likely that beneath the great drift-mantle exists an extensive terrane which is altogether Tertiary in age. Hundreds of well records now seem to admit of new interpretations so far as the lower part of the so-called drift section is concerned.

Should gypsum actually be found associated with the various occurrences of Tertiary pink shales which already have been discovered in many widely separated localities in northwestern Iowa, it would perhaps make this region, already very important, worth more than all other known deposits of gypsum combined.

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Sicilian Sulphur Industry

The production of sulphur in Sicily for 1914 was 334,974 metric tons, a decrease of 11,000 tons from the production of 1913. Exports during 1914 amounted to 338,308 as against 414,716 tons in 1913, according to United States Consul Haven in *Commerce Reports,* Aug. 18, 1915. Production has declined for several years, he reports, owing to lack of capital for financing and to the shutting down of some of the large mines on account of fires.

The production, exports and stocks of sulphur on hand for the last five years are reported in the accompanying table.

SICILIAN SULPHUR STATISTICS

	1910 Metric Tons	1911 Metric Tons	1912 Metric Tons	1913 Metric Tons	1914 Metric Tons
Production	397,808	376,171	357,547	345,974	334,974
Export	393,987	453,826	447,292	414,716	338,308
Stock on hand	640,711	551,422	450,917	376,356	369,001

Owing to the fact that the domestic supply of crude sulphur in the United States meets the demand, none was exported from Sicily to that country. Further, the United States now actively competes with Sicily in the European markets. The decline in Sicilian exports is in part due to this competition, to the increased use of pyrites as a sulphur substitute, and to the paralysis of trade consequent to the war. The exports of sulphur are shown in the accompanying table, giving the countries of destination.

SICILIAN SULPHUR EXPORTS

Destination	1913 Metric Tons	1914 Metric Tons	Destination	1913 Metric Tons	1914 Metric Tons
Sicily	8,504	7,604	Turkey in Europe	1,911	1,177
Italy	72,971	89,611	United States and Canada	1,383	1,919
Austria-Hungary	36,334	25,304	Central and South America	7,340	944
Belgium	13,321	5,977	Egypt	615	1,260
Denmark	305	239	Algeria and Tunis	3,242	2,226
France	75,186	61,871	Asiatic Turkey	3,596	3,914
Germany	31,968	18,824	British India	5,736	4,316
Greece	14,615	15,759	Australia	13,441	1,637
England and Malta	16,036	12,993	South Africa	13,741	2,486
Netherlands	8,975	8,080	Other countries	10,362	9,396
Portugal	14,754	8,427			
Russia	25,892	21,289			
Spain	6,684	9,178			
Sweden and Norway	27,804	23,877	Total	414,716	338,308

The increased cost of the extraction of the ore at the mines induced the producers to petition the government syndicate that controls the sale of the sulphur (Consorzio Obbligatorio per l'Industria Solfifera Siliciana) to advance prices, which request was granted in July, 1914. Prices were increased about 50c. per ton for crude sulphur on board lighters at the port of Girgenti, as follows: Yellow superior, $19.78; yellow inferior, $19.59; brown superior, $19.20; brown inferior, $19.01. (A further advance of 60c. per ton was reported by Consul Samuel H. Shank, of Palermo, early in 1915.)

Crude sulphur in bulk is seldom shipped from Catania. The Consorzio conveys it there for refining and milling purposes and supplies only enough to about fill the demand, and in order to discourage its exports in the natural state from this port the syndicate has established a higher price from Catania than from Girgenti. Refined and milled sulphurs which are chiefly exported from Catania met a fairly active demand during the year. The market prices of refined and milled sulphurs at the end of 1914, per metric ton f.o.b. Catania (in 112-lb. sacks), were as follows: Sublimed flower of sulphur, $34.35; refined sulphur in rolls, $27.98; refined sulphur in lumps, $28.79; and refined ground sulphur, $25.09.

Production of Tungsten and Molybdenum in England

According to the *Times Engineering Supplement,* as quoted by the *Journal of Industrial and Engineering Chemistry,* the outbreak of war found Great Britain deficient in the supplies of many of the rarer metals employed in steel manufacture, and for a time much anxiety was felt respecting the possibilities of manufacturing in England certain of these metals hitherto obtained in large quantities from the Continent. Among these mention may be made of the compounds of chromium, tungsten and molybdenum.

In the case of tungsten, the best wolfram ores are brought from Portugal and India, while the molybdenite used in the preparation of ferromolybdenum comes from Norway, Sweden and Australia. The Australian ores cannot, in the most favorable circumstances, be conveyed from the mines to Britain in less than two months, and as they are extremely costly it would not pay the manufacturer to hold large quantities of ore in reserve.

Process Used at Luton

One factory at Luton, England, has now extended its plant so that it is capable of turning out annually nearly 1000 tons of ferrotungsten and tungsten powder, and it is unlikely that the trade in tungsten powder will ever revert to Germany after the war. The process used at the Luton factory for the production of tungsten powder consists in boiling the finely ground wolfram with a soda solution. The tungstate of soda formed is settled in tanks and dried so as to produce coarse crystals. The compound is then treated with hydrochloric acid in wooden vats, by which means the tungstic acid is liberated as a yellow paste. In order to reduce the acid, it is mixed, after thorough drying, with charcoal in large crucibles and heated for 18 hr. in a reverberatory furnace. The slaglike mass thus prepared is crushed and ground to a fine powder, which is finally passed through 120-mesh wire sieves, and represents tungsten of 98% purity.

In the manufacture of ferrotungsten large 3-ton electric furnaces, each with three suspended electrodes, are used. The feeding of the furnaces takes place by hand in small charges of the mixed ore, with the requisite quantity of carbon, scrap iron and flux. The molten masses of ferrotungsten are drawn off from time to time and after cooling are hand-broken and sorted into various sizes. Owing to the great weight of the material, it is a matter of considerable difficulty to handle it in bulk. It is usually packed in steel casks containing 25 cwt.

The Engineer Function in Modern Warfare

It is being demonstrated that warfare is no longer a display of spectacular heroism, accompanied by a grand fanfare of trumpets, but is largely a question of engineering, one way or another. The use of engineer troops is little understood by the layman, to whom the diversity of engineering features required by an army is astonishing. In the United States Army an engineer company consists of four officers, mounted, and 164 enlisted men, of whom 24 are mounted. Their duties, as outlined in the official bulletin from the office of the Chief of Staff, Washington, D. C., are to apply engineering science to the emergencies of modern warfare in order to protect and assist troops, to ameliorate the conditions under which they are serving and to facilitate locomotion and communication.

Duties of Engineer Companies

In the performance of these duties, engineers are trained and equipped to supplement or amplify, by scientific measures, the efforts of combatant troops in the service of reconnoissance, castrametation, fortification, sieges, demolitions, battlefield illumination, general construction, communication and such other special services of an engineering nature as may arise that are beyond the technical training of combatant troops or such as require the use of engineering implements and material not supplied to combatant troops. The reconnaissance includes both tactical and engineer reconnaissance, surveying, mapping and sketching, photography, drafting and map reproduction. The service of castrametation includes the selection, laying out and preparation of camp and the municipal and sanitary engineering incident thereto, and may include the installation, operation and maintenance of a water-supply system in the case of cantonments.

The service of fortifications pertains both to the attack and the defense and includes the selection of defensive positions when out of the presence of the enemy; rectification of and assistance in the selection of such positions in the presence of the enemy; the location, design and construction of the more important field work; assistance in and supervision of the construction of the hasty defenses wherever possible; the supply of tools and materials; and the reconnoissance, demolitions, water supply and communications incident thereto.

The services of sieges pertains both to the attack and defense, and includes selection and location of defensive line, lines of investment and siege works, the construction of saps, mines, counter-mines and defensive works; the operation of searchlights; preparation for and assistance in attacks, counter-attacks and sorties; organization of captured points; the supply of tools and material; and the reconnoissance, demolition, castrametation, water supply and communications incident thereto. The service of battlefield illumination includes the supply and operation of searchlights, together with any other means to effect the desired end. The service of general construction includes the location, design and construction of wharves, piers, landings, storehouses, hospitals and other such structures of general utility in the theater of operation. The service of communication includes the construction, maintenance and repair of roads, ferries, bridges and industrial structures; the selection and preparation of fords; the construction, maintenance and operation of railways.

To no branch of the engineering profession are these various requirements, either separately or as a whole, more familiar than to the mining engineer. Under average circumstances the conditions under which the military engineer operates are exactly parallel to those under which the mining engineer faces his problems—namely, isolation in the field, lack of tools and equipment, and haste—time being in both instances a most important factor.

With these various engineering problems to be faced it is quickly apparent that a modern army consists of something else besides numbers of men and rifles; and a wonderful field is seen for the mining engineers to render invaluable service, not only in the ultimate issue, but in the present case of improvement and preparation of our national defenses and personnel.

A small number from each engineer company is trained for certain special classes of work, such as sketching, map reproduction, photography, surveying, drafting, demolition, operation of engines, etc.; but practically all of the company are trained for all such kinds of work as roads, fortifications, bridges and mining.

The equipment for each company's use is carried in a combat train, consisting of two wagons containing instruments, tools, tackle, explosives and supplies, for the foot troops; eight mules carrying demolition packs, packs of tools, tackle and supplies, grain, rations and additional tools or explosives, for the mounted detachment of the company. In addition to the equipment carried in the combat trains of the company there is a battalion combat train consisting of one wagon carrying surveying, drafting, photographic and reconnaissance equipment and one wagon containing blacksmith and map reproduction equipment; and also an engineer train of nine wagons with reserve intrenching tools and supplies for infantry, consisting of 234 axes, 63 crowbars, 900 lb. of nails, 1350 mattocks, 4050 sandbags, 117 hand-saws, 117 one- or two-man saws, 2700 shovels, 225 lb. of smooth wire, tool sharpeners, etc.

A battalion, consisting of four companies, of 164 enlisted men each, and the company, battalion and engineer trains, forms a unit of great potentiality in the hands of a competent engineer commander and requires engineering ability of high order to handle, transport and maneuver.

The next Congress will be called upon to make radical changes and additions in our military establishment, and a field is going to be opened for civilian engineers along military or semimilitary lines which will be very attractive, and valuable alike to the country and to the individual engineer.

Miami Copper Co.

The Miami Copper Co. reports that during the first half of 1915 the concentrator treated 589,513 tons of ore, which produced 22,708 tons of concentrate averaging 40.63% Cu. Other data are as follows: Production of merchantable copper, 17,530,865 lb. Average assay of ore, 2.18% Cu. Extraction in milling, 68.16%. Yield of ore per ton, 29.74 lb. of copper.

The finer grinding of the ore, together with improved metallurgical treatment, raised the extraction to 73.98% in June, with only three sections of the mill remodeled. In section 1, remodeled, the extraction was 77.43%.

Extraction of ore from the Captain orebody with the new narrow shrinkage stopes is progressing favorably. The slicing in the main orebody under the large mat of timber has developed in such a successful manner that undoubtedly this method will be continued below the 420-ft. level.

The average cost of copper was 8.6889c. per lb. In June it was only 8.32c. Net income for the half year was $1,296,225, out of which a dividend of $373,556.50 was paid, leaving a surplus of $922,668.69 for the period.

The gross income is apparently figured on an average selling price of about 15.4c. per lb. gross, and the profit amounted to about $1.75 per share. The monthly statistics indicate that this company is working up to a basis of about 50,000,000 lb. per year, which would give it a profit of about $4.75 per share on a 15⅜c. market even if cost of production remained at about 8.7c. per lb.

Mining in China

The Chinese have lately been showing a good deal of interest in the development of their mineral resources. Without any doubt China is going to be a great field for the American mining engineer and the American machinery manufacturer in the not very distant future. According to the New York *Evening Post,* Chou Tzu-Chi, the Chinese Minister of Agriculture, has issued the following order regarding the prospecting of mines in the provinces:

"China is rich in mineral resources, and the reason why mining is not carried on so extensively as it ought to be is that the prospecting work is not done in a thorough manner. When prospecting is poorly done, the minerals are left hidden in the earth. This Ministry has from time to time sent Chinese and foreign engineers to prospect the mines, but on account of the vast area and the unfamiliarity with local conditions, very little progress is made. This Ministry has drawn up regulations governing the prospecting of mines, consisting of seven articles. According to the new arrangement, every magistrate shall make preliminary investigations and submit mineral samples to the Finance Bureau, which shall in its turn send engineers to prospect. Then the Ministry of Agriculture will send engineers to make investigations. The magistrates and the Finance Bureau shall coöperate with and give every facility to the prospecting engineers. The magistrates are required to fill in special forms describing the nature of mines, also of their districts."

The *Chung Hsi Pao* says: "Recently the Wu-fung Mining Co. has located rich deposits of copper in the Choushan Hsien district at places called Dunkaitai and Sikou. A rich capitalist, Mr. Wang, has petitioned the Civil Governor to grant him the right to work the mines at Dunkaitai. As the copper which is used by the Wuchang copper mint in large quantities was imported from Japan, now that local copper mines have been discovered it is necessary to have them developed with the view of supplying the provincial mint. The land partly belongs to the people and partly to the Government, so a boundary line must be marked out in order to prevent future troubles. The Governor has deputed Mr. Yuan to go to the place to verify the report, as well as to mark out the boundary lines."

The Broken Hill Proprietary Co. has closed a contract to furnish the New South Wales Government with 700 tons of rails weekly from its new steel works at Newcastle. The contract is to run for a year, and the price is £7 17s. 6d.—equal to $38.32—per ton at mill.

Valuation of Arizona's Producing Mines

SPECIAL CORRESPONDENCE

The State Tax Commission has announced its valuations on the mines of Arizona. The first Legislature passed an income-tax law providing for a certain proportion of the net, plus a proportion of the gross income, as the valuation for assessment purposes. But this law was operative for only two years, and in spite of considerable urging by the big mines, this last Legislature could not agree on a net-income valuation, which was the demand of the miners. In fact, there was a big fight on over this matter between those representatives favorable to the miners' contention and those headed by the governor who believed that this was not a fair tax valuation. At any rate, the Senate split with the House, and no legislation on the subject was passed, leaving it to the Tax Commission to decide on the valuations. It is believed that in this duty, the commission followed the Michigan plan, as Tax Commissioner Allen of that state was in Phoenix last winter and there outlined their methods and aspirations in full to the public.

The total valuation of mines arrived at by the commission is $121,225,833, an increase of $11,000,000 over last year; but allowing for mines that commenced production during last year, the increase is about 10%, and most of this comes on a few of the larger mines. It will be seen that the old rate of four times the net income, plus one-eighth of the gross income, was a very good guess at a fair valuation if the present figures are anywhere near right. There is a good deal of fault found with this year's results, however, and a number of the mines, notably the Copper Queen, are asking the Tax Commissioner for a rehearing. It must also be noted that these valuations are only for the producing mines, as the nonproducers are not taxed. The final valuations are as follows:

	Mining Property	Improvements
Arizona Commercial Co.	$109,134	$95,787
Arizona Copper Co., Ltd.	6,709,544	6,226,191
Arizona United Mining Co.	28,216	21,570
Bunker Hill Mines Co.	186,750	121,072
Calumet & Arizona Mining Co.	2,054,289	2,895,125
Commercial Mining Co.	37,250	10,300
Commonwealth M. & M. Co.	82,608	290,200
Cons. Arizona Smelting Co.	74,509	364,980
Copper Queen Cons. Mining Co.	29,357,656	5,143,954
Detroit Mining Co.	5,167,981	1,765,085
Duquesne M. & Red. Co.	128,636	75,538
Gold Roads Mining Co.	262,670	166,940
Great Western Copper Co.	41,666	8,778
Thomas Higgins	24,632	....
Inspiration Cons. Copper Co.	1,657,817	2,694,846
Iron Cap Copper Co.	119,205	3,250
Leonard Copper Co.	74,378	25,621
Magma Copper Co.	158,118	221,830
Miami Copper Co.	8,739,379	2,746,634
Needles M. & S. Co.	83,960	34,579
Old Dominion C. M. & S. Co.	4,760,488	2,964,911
Ray Cons. Copper Co.	11,904,346	4,709,472
R. R. Richardson	427,362	3,225
Shannon Copper Co.	1,300,192	1,129,980
Shattuck Arizona Copper Co.	4,794,287	89,423
Superior & Boston Copper Co.	55,725	34,785
Superior & Pittsburg Copper Co.	20,551,670	192,010
Tom Reed Gold Mines Co.	3,034,060	175,500
Union Basin Mining Co.	176,677	45,574
United Globe Mines	3,012,767	40,791
United Verde Copper Co.	15,319,160	3,754,480
Vulture Mines Co.	338,490	177,892
Warrior Copper Co.	139,992	8,567
Wolverine & Arizona Mining Co.	143,462	2,200
World's Fair Mine Co., Frank and Josephine Powers, owners	169,093	....
Total for the State	$121,225,833	$35,361,082

These valuations include tracks, etc., heretofore assessed as railroad property, to the amount of $1,455,260.

The Copper Queen continues the heaviest taxpaying company, with a total valuation of $29,357,656, an increase of approximately $3,000,000. The Superior & Pittsburg is next, with $20,000,000, an increase from $16,000,000. This is the greatest individual raise. Inspiration enters the list of producers for the first time, with a valuation of $1,500,000. There are slight increases in Ray, United Verde, Miami and other big companies, while the Arizona Copper Co. drops from $8,000,000 to $6,000,000. Cochise heads the counties in mine valuation with a total of $58,325,468; Gila is next, with $18,538,484; Greenlee has $13,000,000; Pinal, $11,000,000; Yavapai, $15,000,000; Mohave, $3,000,000; Santa Cruz, $725,000, and Maricopa, $338,000.

Progress in the Metallurgy of Zinc in Great Britain

According to the 51st annual report of the British Alkali Inspector, further attention was given during 1914 to the conditions influencing the formation of fume, the means for preventing the escape of fume, and the best methods of dealing with the solid material obtained by such means. Further experiments were made on the fume-arresting efficiency of various types of iron prolong, with special regard to the form favored at each works, and temperature conditions were studied in detail. Owing to the wide difference of practice obtaining at various works, it has been found difficult to state principles capable of general application, but lines for suggested improvement are indicated. The form of prolong favored where oxide or "ashes" are distilled is a cone having a removable cap and divided horizontally into two compartments by a shelf; the gases return over the shelf and are discharged through a wide slotted hole close to the furnace front and well under the ventilation hood. The prolong is constructed to fit the receiver to which it is attached, and its weight is supported by suitable bars hung in front of the furnace. When granular zinc alone is distilled, coke packing is introduced into the upper compartment. The results of the various temperature tests are presented in tables and graphs.

Very similar temperature gradients were observed in works utilizing mainly ore and in those where zinc "ashes" containing volatile chlorides formed the bulk of the charge, although the weights of fume arrested in the two classes of operation were as 2 to 1. The proportion of fume evolved appears to depend on the volume of gas formed, that is, on the proportion of oxide present in the charge, and, for the same class of operation, would seem to be closely related to the heat of the furnace. The greater part of the volatilized chlorine is in the form of zinc chloride, and preliminary experiments showed that on simple treatment with water, the bulk of the chloride could be extracted from the fume and skimmings and recovered, instead of ultimately escaping into the air. The metallic residue could be dried, without risk of firing, before returning to the furnace with a subsequent charge. Hot water should not be used in washing the fume. With a charge of "ashes," the vapors discharged from the receivers during the "steaming stage" were acid to methyl orange and contained free hydrochloric acid, whereas when the charge consisted mainly of ore, the vapors were alkaline, containing free ammonia.

A Byproduct Coke Plant with a capacity of about 2000 tons daily is to be erected in connection with the blast furnaces which are being built by Corrigan, McKinney & Co. at Cleveland, Ohio. The contracts have just been placed.

Mineral-Industry Exhibit at the National Museum

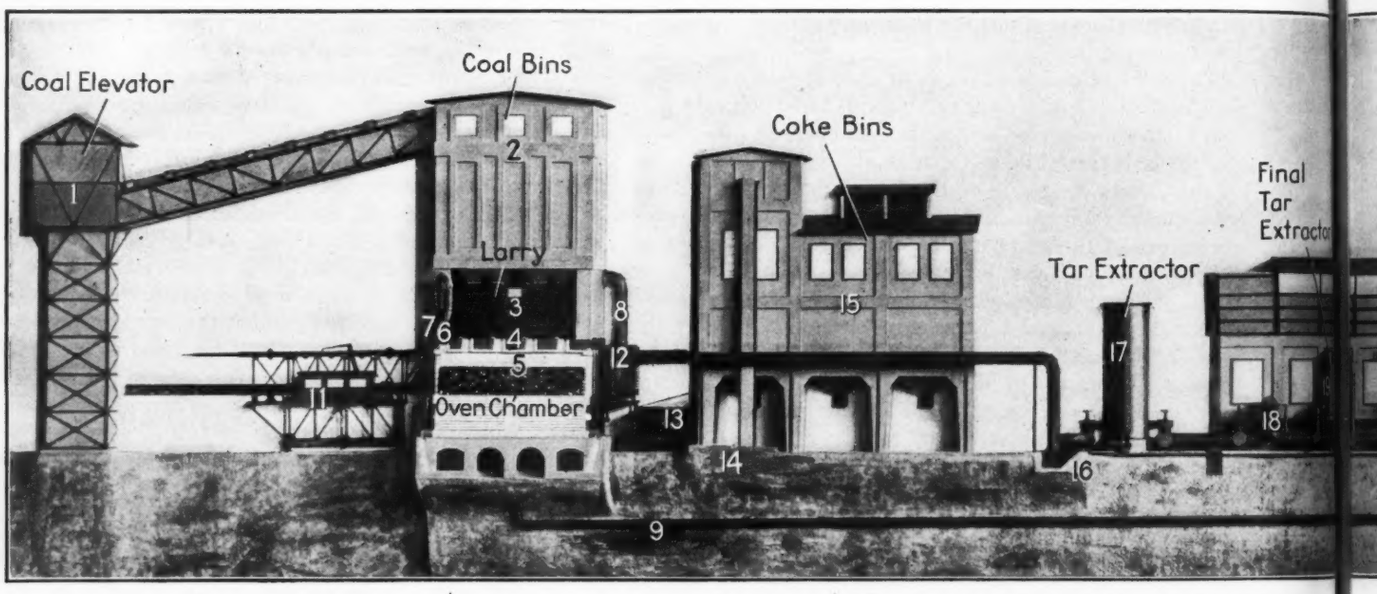
By Chester G. Gilbert*

SYNOPSIS—Model reproductions of each important type of mineral industry, presenting the processes from natural occurrences to finished products, is intended to promote a better appreciation of these industries on the part of the public. The exhibits in the National Museum at Washington are to be supplemented by educational bulletins for popular distribution.

For the purpose of creating a fuller appreciation by the public of its indebtedness to mining and metallurgical enterprises the Smithsonian Institution has arranged for a group of mineral-industry exhibits in the National Museum at Washington. The work is being carried forward in coöperation with important mining and industrial interests, including the Utah Copper Co., National Lead Co., New Jersey Zinc Co., U. S. Steel Corporation, Joseph Dixon Crucible Co., Barber Asphalt Paving Co., Solvay Process Co., American Coal Products Co., Macbeth-Evans Glass Co., etc. With the coöperation of such companies, it is evident that this movement is to be worthy of the interest of all engaged in the mineral industry.

About the middle of 1913, mineral technology was given active recognition in the form of a distinct division in the National Museum. Publicity for this work has been consistently avoided up to the present, but now, at the close of the second year of the new division's active existence, conditions are sufficiently advanced to warrant the statement not only of a definite purpose and of the means to the end in view, but also of assurances derivable from the test of practical application.

From the outset it seemed apparent that technical science and engineering were already adequately provided with media for the intercommunication of ideas, but that the public, whose interest after all is the really vital one, might profit by a more adequate grasp of the mineral technology of the country, and that the opening up of better lines of communication between the producing and consuming extremities might well tend toward a fuller appreciation that would be mutually profitable. In the assumption of such a function, moreover, the Smithsonian Institution would be exercising a peculiar fitness in that such an effort would be projected in its normal direction of a broadening educational influence.



MODEL OF A KOPPERS BYPRODUCT-COKE PLANT AT THE

This wall model is 28 ft. long by 7 ft. high and is constructed accurately to a scale of about 1/50 actual size. Beginning at the left-hand end of the photograph, the coal hoist is shown conveying coal to the hoppers over the ovens, where chutes feed it into the larry (3), which carries the coal to various ovens and feeds it into the oven chamber (5). No. 11 represents the coke pusher, and Nos. 12, 13 and 14 the coke guide, car and pit respectively. The coke is elevated and delivered into No. 15, which represents the coke-screening station from which the coke is withdrawn into cars and shipped. The gases ascend from the ovens through pipes (6 and 7), and are conveyed by No. 8 to the sump (16), where part of

Mining Not Comprehended by the Public

Viewed in the light of popular comprehension, agriculture and mining—the life and backbone of the country—are in striking contrast. Agriculture is ever present, whereas mining is by nature seclusive, to say the least. With the one, the average mind is thus enabled to project itself, by analogy at least, in a comprehensive motion-picture conception of realities; with the other, the opportunity for the development of any such capacity has commonly been lacking, and the result is at best nothing more than a few scattering snapshots of disjointed facts,

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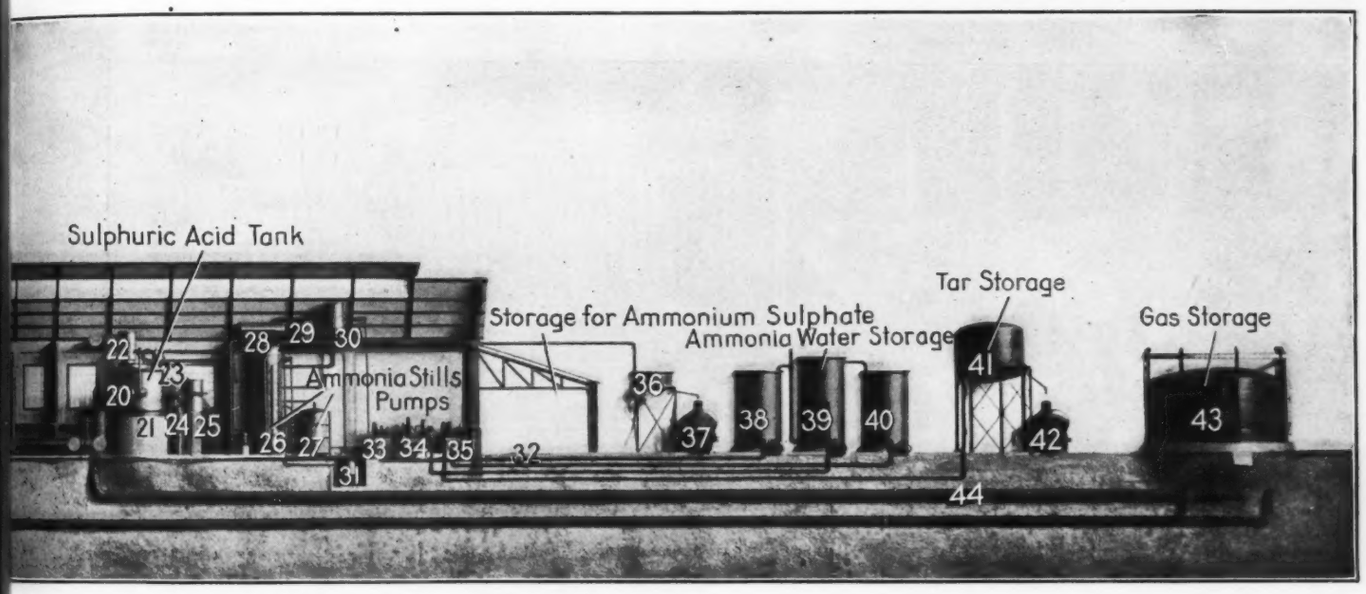
without the least sequential conception as to the real nature or extent of a given accomplishment. To many people, mining suggests only a twin brother to horse racing, with all the romantic allurements of "inside dope" and "200 to 1 killings." A vision which sees only infesting parasites is the surest evidence of ignorance; and in the case of a commonwealth contemplating its own backbone with such results the ignorance evidenced is calamitous.

Mining and the mineral industries do not represent an errant bit of Utopia uncontaminated, nor are they utterly bad; they are just human, and being human share in the dominant traits of thriving on appreciation as to true worth, and meanwhile measuring up to expectations good or bad. Merited appreciation and unmerited suspicion are just as potent character makers and breakers in industrial life as in that of the individual. To an industry the practical result of indiscriminate suspicion lies in weakened pride and lessened efficiency. To the public the result is felt in a tendency toward the creation of inferior values, coupled with an upward tendency in costs. To the country it means impaired stimulus for achievement.



UNITED STATES NATIONAL MUSEUM, WASHINGTON, D. C.

the tar is removed. Continuing through tar extractor (17), the gases are forced by the exhauster (18) through the final tar extractor (19) and then to the sulphuric-acid tank, where part of the ammonia is taken out as ammonium sulphate and stored in the storage house (32). From the sulphuric-acid tank the gases continue through pipe (44) to the gas holder (43) at the extreme right of the panel. Nos. 26 and 27 are the free and fixed ammonia stills for obtaining ammonia water, and this solution is pumped by means of pumps (33, 34 and 35) to their respective tanks. The tar coming from sump (16) and the extractors (17 and 19) is pumped through to the storage tank (41), from which it is loaded into cars.

Developing High-Quality Products

There comes to mind a prominent American manufacturer operating in a mineral-industry field where for generations a foreign name has been the unquestionable standard the world over. Now in his fullest maturity this man, leaving the routine of affairs to others, is devoting his undivided attention to perfecting special-quality products to the point where they will surpass those of the foreign standard. His efforts have already met with success in several directions, and in others success is practically assured. As a result, not only are millions of people in this country today profiting by a far better grade of normal product without increased cost, but American genius has also asserted itself over foreign genius backed by a lengthy heritage in skilled artisanship, a new-world standard bearing an American name may be created for an important line of special products and the road opened for the development of important industries. An example of self-sacrificing devotion to industrial effort actuated by patriotism and pride in achievement! There are plenty of others; and such a reflection spread nation-wide would inspire to an infinitely greater national achievement than could ever arise from reflection on the ways of parasites.

It is in the nature of things that the eternal enemies of progress—ignorance and inference—should be especially potent in the general field of mining, for there is no other activity with its significance of demand on attention and at the same time so utterly out of touch with the range of normal human experience. Fake prospectuses and fancy prices do not deserve to characterize mining any more than proprietary fakes and princely fees actually do medicine, but the one group represents about all that effectually reaches the public, while the other is recognized in its true bearing and only serves to reflect the greater credit on what is real in the profession.

Aim of the Mineral-Technology Division

Passing now from analysis of conditions as they have been to the means devised for helping to improve them "the plans[1] for the development of the Division of Mineral Technology aim toward an embodiment devoted to the interests of the public at large, as opposed to the abstractly scientific or highly technical, and with energies directed toward the extension of cultural learning, together with information concerning current utilitarian facts. In the attainment of these results, it is proposed—to the extent that space is available—to prepare a model

[1] "Report on the Progress and Condition of the United States National Museum for the Year Ending June 30, 1914"; Richard Rathbun, assistant secretary-in-charge.

reproduction of each important type of mineral industry operating in the field, tracing conditions and processes from natural occurrence to finished products; around that model reproduction as a central theme to assemble in each instance such a systematic exhibit as will best serve to emphasize important features in both manufacturing processes and industrial capabilities; and finally, as each respective series is completed, to make it the basis of an educational bulletin for popular distribution." In other words, the aim is toward enabling the average individual to realize that an ore contains a metal and what the process of reduction implies. It is intended to make the individual familiar in a general way with the life history of the salt he uses and of the plaster on the four walls inclosing him; to familiarize him with the significance of hydrated lime, monel metal, artificial graphite, special-purpose glass and the various other developments, already here and to come, touching on his well-being.

It is possible to misdirect any activity, especially by overdirection. In the present instance overdirection would mean gratuitous advertising, favorable or unfavorable, through the proverbially odious medium of comparison. A presentation of the salient facts involved in a commonsense understanding of conditions, processes and products with their properties, put forth in the manner best suited to catch and hold interest in each separate instance, is the whole end in view. For the museum visitor there will be a minimum of learned effusions in the form of labeling, and a maximum of visualization, so that more or less unaided he may see the ore in its native occurrence, follow through the successive steps and processes, and see exemplifications of products together with their properties when put to practical test. For the public at large illustrations will have to be substituted for realities, but otherwise the same presentation will be available in the form of a bulletin.

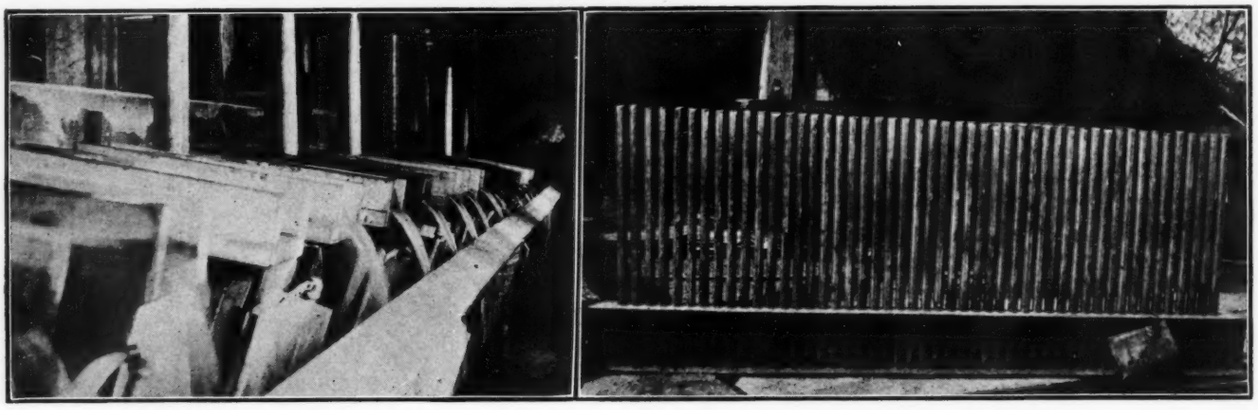
Hearty Coöperation by Producers

Industrial coöperation is essential in this effort, and with but one exception has been given unreservedly from every source thus far approached. The magnitude and diversity of the activities in process of representation at the expiration of the first active year of the movement's existence are suggested by such leaders in the mineral industry as have already been mentioned. Perhaps the most significant feature thus far developed lies in the fact that there has not yet arisen a single instance where industrial coöperation has sought to inject an element of bias or discrimination.. The mere fact of readiness to coöperate might simply imply ulterior motives, but the purely impersonal element implies genuine public-spiritedness. In addition to sharing in the general advancement of conditions promoted, the coöperator has his reward in the public recognition of a service; but it is only such recognition as comes to the contributor along conventional lines, and for those who are disposed to ascribe narrow-minded selfishness to industrial interests it is worthy of note that a total of 17 unqualified responses out of 18 solicitations, involving outlays in some instances of several thousands of dollars, will certainly compare favorably with the showing in more conventionally philanthropic circles.

Gold Recovery at Placer Mines

By D. F. Carver*

Discussion of gold-recovery methods in placer mining has shown but few improvements aside from the operation of dredging. That some improvement in a system ought to be forthcoming after its long-continued use seems reasonable, and one case where progress has really been made will be described here.



Launders and classifier pipes — Bottom view of spring-steel grizzly

GOLD-SAVING DEVICES AT CAMP CARSON PLACER, UNION COUNTY, OREGON

This system of handling placer material has been in use in California for several years and has recently been installed at the Camp Carson mine in the Blue Mountains, Union County, Oregon. One difficulty in the past has been to handle the material with the primitive sluice-box arrangement. When most of the gold was fine, in the cases of gravels that rapidly filled the riffles, the fine gold passed over the latter into the dump. The tailings in some instances would assay as much as the ground being worked. I shall give here a description of the modified method of operation.

Block Riffles Recover Coarse Gold

The old sluice-boxes with block riffles are used to recover the coarse gold. Experience has shown them to be well-adapted for saving such material. The riffles in the first two boxes are placed in such a manner as to be easily taken up, allowing ready access to the coarse gold that lodges in the first few feet of sluices. At the end of this sluice eight sets of steel grizzlies are placed so

*Camp Carson Mining and Power Co., 1004 American Bank Building, Seattle, Wash.

that the heavy material, over ¼ in. in size, is carried into the dump. The finer material is sifted through into an undercurrent flume. The grizzlies do away with all the heavy oversize which has no value and allow the fine material containing the higher value to be handled in a most efficient manner. The flow of water is regulated at this point by a pair of gates designed to balance the water and so permit the oversize to be washed away. The grizzlies are so arranged that the ends of each set project over the next in such a way as to be free of contact. Thus, with one end free, the bars are kept in constant vibration by the heavy boulders passing over them; this prevents the material from clogging the grizzlies and makes the system automatic.

Use of Concentrating Tables

The fine material is carried from this point to a set of nine tables, each 2 ft. 6 in. wide and 8 ft. long, with a drop of 2 in. per ft. On these tables are small steel angle riffles, ⅝ in. in size, ¾ in. apart. They are made in frames which are held in place on the tables by strips of wood and which in turn are secured by wedges. The material coming from the undercurrent flume is distributed evenly over all the tables by gates at the head of each table, opening from a small sluice into which the material runs after leaving the undercurrent flume. The flow of water over these tables is not greater than 1 in. in depth, so that there is no possibility of the fine gold riding past the riffles.

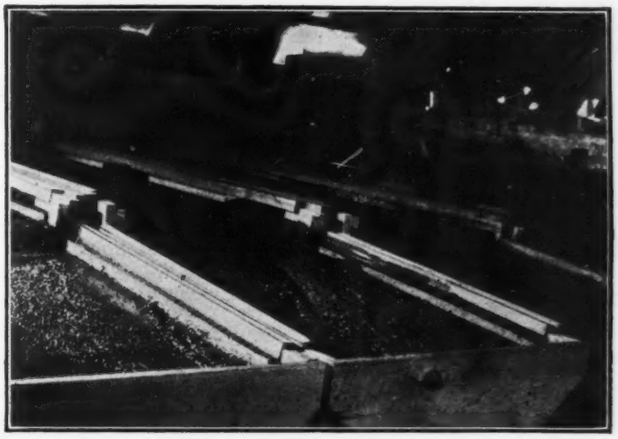
At the entrance to the tables, before the material reaches the small riffles, are 18 trays containing quicksilver—two trays to each table. These trays are similar to those used by the uptodate dredges and are useful in

GRIZZLIES IN PLACE IN THE LAUNDER

catching the fine free gold. The riffles on the tables can be removed if desired, one section at a time, without interfering with the operation of the other tables. It is the work of but 10 min. to remove the riffles of one table, shovel the material into a cleanup box, replace the riffles and remove those of the next table. This permits a cleanup to be made at any time without stopping mining operations in general.

A further separation of material that passes over the small riffles is made by a set of steel screens and hydraulic classifiers. There are nine pairs of the hydraulic classifiers installed below the steel screens. The latter have $\frac{1}{10}$-in. holes, and any material which passes through them is carried into the classifiers, where a separation is made with water under pressure. The light material which contains no gold is taken out of an opening in the upper part of the classifier, while the heavy material drops into the bottom and is taken out through a pipe and then run through a magnetic separator for final cleaning. The classifiers are automatic and, once the flow of water is properly regulated, do not require any attention.

A magnetic separator of large capacity treats the material coming from the lowest opening in the classifiers. This contains principally iron compounds which are picked up by the magnet and carried off on a belt to the



TABLES WITH ⅝-IN. ANGLE-IRON RIFFLES

dump. Gold, being nonmagnetic, drops into the bottom of the separator and is carried into a cleanup box. The belt that carries off the magnetic material covers the surface of the magnet completely, and as the iron sand clings to the surface of the belt and not to the magnet itself, it is automatically cleaned off at each revolution as the belt runs from the magnet.

A large tonnage can be handled at a cost of less than 5c. per cu.yd., and practically all the gold is recovered. Material as low as 8 and 9c. per cu.yd. can be worked at a profit when sufficient tonnage is handled. This recovery system may be used on placer ground that is not suitable for dredging, and can be installed at little cost. At the Camp Carson property all these modifications have been in use a sufficient length of time to remove them from the classification of experiments.

General Petroleum Co.

Editorial Correspondence

The General Petroleum Co.'s balance sheet as of June 30, 1915, and the profit and loss statement for the six months' operation ended June 30 show a decrease in net profit from sales of oil at the wells, due particularly to the decrease in price of light-gravity oil. The profits shown in operation for the six months are materially accounted for by special earnings from a dividend of the Trumble Refining Co., due to the sale of rights of that company. The comparative balance sheet shows assets and liabilities equal to $61,128,450. The capital assets include five items, totaling $57,571,588. The largest item in this group is oil lands and other property amounting to $49,414,962. The next largest item is development and equipment, which amount to $6,212,-

523. The advances to controlled companies, including Federal Oil General Construction, General Water and miscellaneous, totaled $303,585. Capital liabilities amounted to $51,401,700, and the capital surplus, $4,764,607. Deferred payments on lands payable in oil amounted to $25,423, and payable in cash, $35,130. The liabilities to controlled companies totaled $748,495, divided between General Pipe Line and Trumble Refining Co. A suit filed by Mrs. Julia Goldman, a bondholder of General Petroleum, for redemption with interest of ten $1000 bonds is looked upon by some officers of the company as being evidence of opposition to the reorganization plan now being worked out.

New Mill at Elko Prince Mine, Midas, Nevada

SPECIAL CORRESPONDENCE

Construction of the Elko Prince mill on the property of the Elko Prince Mining Co., at Midas, Elko County, Nev., is well under way. Excavation work is completed, the forms are off from most of the concrete foundations and some of the mill framing is now being erected. The mill is being constructed for the Elko Prince Leasing Co. by the Dorr Cyanide Machinery Co., and will cost about $100,000. The daily capacity of the mill will be 50 tons. Ore from the Elko Prince mine and customs ores will be treated. A sampler will be installed in the mill building proper so that custom ores may be used as soon as the mill is ready for operations—probably in December.

The ore will be delivered into bins that will discharge upon a short conveyor feeding into a Telsmith gyratory crusher; the crushed ore will be raised by elevator to the fine-ore bin, whence it will be carried by a special conveyor to a 4-ft. Marcy steel-ball mill, which in turn will discharge into a 5x14-ft. tube mill; thence to a Dorr classifier, the oversize being returned to the tube mill. The Dorr process of counter-current decantation will be used, requiring three agitating vats and two Dorr tray thickeners. The pulp will then pass to an Oliver filter; the gold and silver will be precipitated by zinc dust; a Merrill press will be used. Power will be suppied by a 185-hp. Allis-Chalmers oil engine. Water will be pumped from a gulch at Midas through a 10,000-ft. pipe line to the mill.

Midas is in the Gold Circle mining district, about 50 mi. northeast of Golconda on the Southern Pacific and 35 mi. from Red House on the Western Pacific R.R. An autotruck runs regularly between Midas and Golconda, the roads being in fair shape and on easy grades. The hauling of machinery and supplies is from Red House.

The Gold Circle formation includes chiefly rhyolite, andesite and "bostonite." The mineralization is in vertical fissures in the rhyolite, the hanging wall of the veins in the Elko Prince mine being bostonite. The Elko Prince mine is developed by a crosscut adit about 700 ft. long, from which drifting has been done northward and southward a total distance of from 1,100 to 1,200 ft. on the vein, giving about 350 ft. of backs above this level. Raises and drifts have opened the ground above this level, while winzes and drifts have opened the vein to a depth of 750 ft. and for some distance along the strike.

The vein is a quartz filling carrying gold with silver sulphide. It breaks clean from the bostonite hanging wall but is not so well defined on the rhyolite foot wall, being scattered along numerous planes parallel to the strike with cross-fissures into which the mineralization has penetrated so that the working width will be largely determined by the ability of the miners to carry a narrow stope and by the grade of the rhyolite that will pay to mine. It has been estimated that sufficient ore has been blocked out to net $500,000 over the cost of the mill and operating expenses. The ore averages $40 per ton.

Little mining work is being done at present, but stoping will soon be started. A shrinkage method of stoping will be followed and an effort made to hold the stoping width down to 30 in. Probably sorting in the stopes will be adopted to throw out all coarse foot-wall rock that may be broken. Power drills are used in the mine, the compressor being driven by a Fairbanks-Morse oil engine. An oil engine also drives a dynamo supplying current for a small hoist, and a large compressed-air hoist is installed to raise ore from the levels below the tunnel through the 300-ft. winze which is timbered and equipped with headgear and cage for raising ore cars.

ELLERS LEASE OPENED IMPORTANT VEIN

Paul Ellers, working since January on a lease on the June Belle claim of the Elko Prince property, has opened a new vein paralleling the Elko Prince. It has about the same characteristics as the Elko Prince vein but with indications of proving of greater average width, so there are good grounds for believing that this vein may double the value of the Elko Prince mine. The lessee considers anything from $20 upward as "pay." He is screening the waste, the fines from which are profitable to mill. Custom treatment at the Rex mill costs about $7 per ton and haulage, 50c. Ellers expects to ship steadily to the Rex mill until the Elko Prince mill is completed. The Rex mill has been running under lease from the Battle Mountain owners by Howell & Liddell for about 18 months. It has been reworking old tailings while waiting for Ellers to make steady shipments. The ore developed in the Rex mine is practically worked out, so that the mine will not be able to supply the mill until further progress has been made in opening new orebodies.

Thorianite in Madagascar

The occurrence of thorianite in the Province of Betroka, Southeastern Madagascar, is reported by M. A. Lacroix before the Société de Mines of France. A preliminary analysis gave thoria, 93.02 per cent.; uranium oxide, 4.73; ferric oxide, 0.29; lead oxide, 1.80. The conditions of occurrence remain to be studied. While Mr. Lacroix describes thorianite as a mineral hitherto known only in Ceylon, the *Bulletin* of the Imperial Institute for 1912, page 514, notes the occurrence of thorianite in a gold-placer deposit on the river Boshagoch in the Transbaikal province of Asiatic Russia.

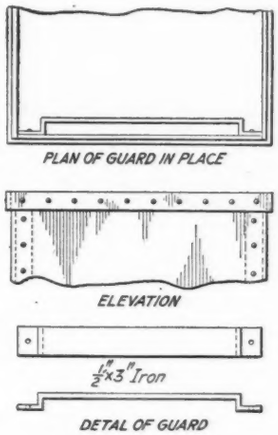
There Were 66,566 Short Tons of Domestic Ocher, umber, sienna, mineral paint, mortar color and ground slate and shale sold in 1914, which was less by 4029 tons than the sales of similar pigments in 1913. Of white pigments—zinc oxide, leaded zinc and the basic sulphate of lead produced by sublimation—there were sold 106,791 tons in 1914. The lead pigments made chemically, including basic-carbonate white lead, litharge red lead, orange mineral and lithopone, showed a decided increase, 245,206 short tons of these pigments having been sold in 1914.

Details of Practical Mining

Finger Guard on Tram Car

By A. E. Hall*

Many minor accidents are caused by chunks of ore crushing the fingers of the trammers against the car rim. In the *Journal* of Mar. 20 a handrail was described which was fastened to the rear of the car and which the trammers grasped instead of the rim of the car body.



FINGER GUARD FOR TRAM CAR

In the accompanying illustration is shown another scheme which is used at Sudbury mines for the same purpose as the outside handrail. Instead of angle iron at the top of the car, there is a strip of ½x3-in. iron running all around. The guard shown was placed on the inside of the car and although it takes up practically no room it accomplishes its purpose very satisfactorily. It is simply a piece of ½x3-in. iron bent as shown and placed inside the car and riveted to the car body. The trammer's fingers go between the guard and the car body.

Traction Rope on Aerial Tramways†

The traction or hauling rope for an aërial tramway is invariably a stranded rope with a hemp core, the flexibility depending on the size of the individual wires in the strand and the breaking stress of the material. This rope is endless and in constant motion. In general practice it passes around a driving sheave at one end of the line and around a surging or tension sheave at the other end.

The diameter of the hauling rope depends upon the highest tension occurring in it. To obtain this tension, various formulas are employed, but as it depends upon the weight and friction of the cars and hauling rope, it may be summarized thus:

$$Tension = [initial\ tension + \left(\frac{W}{S} \times H\right) + (w + H)] + [(W + \mu_1 \times N) + (L \times \mu_2 \times w) + (R \times 2)]$$

Where

W = weight of full carrier;
S = spacing of carriers in feet;
H = difference in level between stations in feet;
w = weight per foot of traction rope;
μ_1 = coëfficient of friction of cars;
μ_2 = coëfficient of friction of traction rope;
L = length of line in feet;
N = number of carriers on one side of line;
R = number of supporting rollers on one side of line.

This gives the tension in the rope in pounds, which if multiplied by the factor of safety 6 to 8, and divided by the breaking stress, gives the area of the rope necessary. This is for the general case with the drive at the upper terminal and the load ascending. When the loads are descending the plus sign in the center of the formula becomes minus. To obtain the tension when the ropeway is just put into work, the second half of the formula should be doubled.

Normal Underground Temperatures

Men cannot work with full efficiency in high temperature; consequently for both economic and hygienic reasons high temperatures in working places ought to be prevented. This subject has been studied extensively by a Royal Commission on Mining Industry at Broken Hill, New South Wales, from which report, 1914, there appears to be a wide difference of opinion as to what should be the standard of normal working temperatures. In Western Australia the standard is 87° F. dry and 80° F. wet bulb; in Victoria 83° F. wet bulb; in New Zealand 80° F. wet bulb; in Queensland a reasonable degree of humidity must be maintained; that is, at 85° F. dry the wet bulb must not exceed 80° F. If the dry bulb exceeds 85° F., the wet bulb must be at least 7° less.

Quoting from the Royal Commission on Coal Mines, 1909, in Great Britain, the report says: "The existing evidence indicates that in still and saturated air, continuous hard work is practically impossible at temperatures exceeding 80° F., even when men are stripped to the waist; and that, when the air temperature is higher than this, the result is the same if the wet-bulb temperature rises above 80° F. A temperature of 100° F. or 110° F. with the air so dry that the wet-bulb temperature is only 80° F. is thus no worse than air completely saturated with moisture at 80° F. In other words, it is the wet-bulb temperature, and not the actual temperature of the air, that matters when the air temperature is high. In moving air, however, a somewhat higher wet-bulb temperature can be borne than in still air. At wet-bulb temperatures exceeding 80° F., the amount of continuous work which a man is capable of doing without serious rise of bodily temperature rapidly falls off and becomes practically nothing at 90° F. wet bulb. Inasmuch as it seems clear that, for the economical working of a mine, the wet-bulb temperature should not in general be allowed to rise above 81° F., unless there is a good air current, great importance attaches to studying the causes of excessive heat and moisture in mines, and so arranging the ventilation as to

*Creighton Mine, Ont.

†Abstract from article in the "Engineer," London, July 23, 1915.

keep the wet-bulb thermomoter within reasonable limits and insure a good air current throughout the working places of the mines.

The Life of Wood Pipe

The results of an investigation of the lasting qualities of wood pipe carrying water, made under instructions from the director and chief engineer of the Reclamation Service, are given at great length by D. C. Henny, consulting engineer, for the service at Portland, Ore., in *Engineering News,* Aug. 26.

This inquiry on the life of wood pipe covered three general types—continuous wood-stave, section wood-stave and sectional bored.

Reviewing the information, it may be estimated that under conditions of continuous water pressure the life of various kinds of pipe may be as follows:

Wood	Condition	Years
Fir	Uncoated, buried in tight soil	20
Fir	Uncoated, buried in loose soil	4–7
Fir	Uncoated, in air	12–20
Redwood	Uncoated, buried in tight soil, loam or sand, and gravel	Over 25
Fir	Well coated, buried in tight soil	25
Fir	Well coated, buried in loose soil	15–20

Under conditions interfering with complete saturation of the wood, the life is cut down materially. These conditions are in the case of uncoated pipe brought about by open soil and low water pressure. The effect of coating appears to be equivalent to tight soil cover, with possibly the additional advantage of tar in the coating acting as a disinfectant. The effect of unfavorable conditions as to lack of complete saturation is serious in redwood, resulting in a life which may be shorter than 15 years.

On the whole the following conclusions seem justified as regards the relative life of fir and redwood in pipe:

(a) Under favorable conditions of complete saturation fir well coated may have the same life as redwood uncoated.

(b) Either kind of pipe will have a longer life if well buried in tight soil than if exposed to the atmosphere. Such life may be very long, 30 years and over, if a high, steady pressure is maintained.

(c) Either kind of pipe will have a longer life if exposed to the atmosphere than if buried in open soil, such as sand and gravel and volcanic ash, provided in hot and dry climate it be shaded from the sun.

(d) Under questionable conditions, such as light pressure or partially filled pipe, fir, even if well coated, may have only from one-third to one-half the life of redwood.

(e) Under light pressure the use of bastard-sawn staves in fir pipe should be avoided.

(f) The use of wooden sleeves in connection with wire-wound pipe is objectionable and has caused endless trouble and expense. It is possible that the objection may be partially overcome by dipping ends of sleeves in creosote and by applying a heavy coating of tar to the ends of the sleeves. Saturation of sleeve wood will never be as perfect, however, as of the straight pipe, and full creosote treatment of the wood or else some form of metal sleeve, either riveted iron or steel heavily coated, or cast iron will probably be well worth the extra cost.

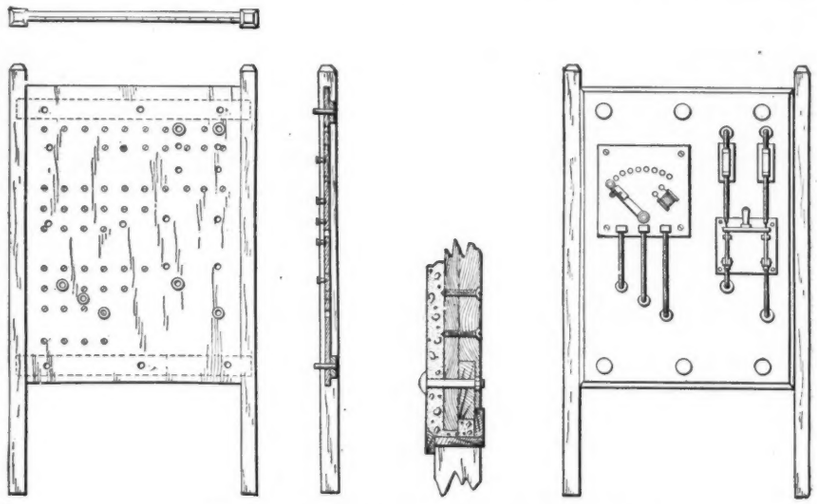
(g) If wooden sleeves are employed, they should be provided for sizes at least from 10 in. up with individual bands to permit taking up leaks.

Wood pipe is not suitable in cases where it cannot be kept full and under pressure during periods of use. Coating cannot under such conditions be expected to afford protection against decay. Coating should be continuous and heavy, not less than one-sixteenth inch to be fully effective, and should preferably consist of more than one individual coat of a mixture of asphaltum and tar, or of an application of gas tar followed by one or more applications of refined coal tar. Little experience, however, can be quoted in support of all-tar coating.

Concrete Switchboard

In a mill where I was employed there is a 500-volt, direct-current motor driving the machine shop, says J. R. Chapman, in *Power.* The switch, fuse blocks and rheostat were fastened to the wall of the building with sheet asbestos for protection.

One day the insurance inspector came in and insisted that a change be made to comply with the underwriters' rules. I suggested getting a slate board, but it was finally decided that a home-made board would do. Accordingly, I took two pieces of 3x3-in. hard wood, 7 ft. long and mortised in two cross-pieces, making a frame 4 ft. wide, as shown above. This was covered with dry pine boards between the uprights, making a tight back for the form. I next placed the fuse blocks, switch and rheostat on the board and marked where the bolt holes came and where the wires would pass. Through the cross-pieces I bored ⅝-in. holes and drove in wooden pins, leaving them 2 or 3 in. long.



FORM FOR SWITCHBOARD AND END SECTION

For the wires I bored holes to fit porcelain insulation tubes 3 in. long and drove them in as far as necessary. The face of the board was set with 1½-in. screws projecting about 1 in. and spaced 4 in. each. One-inch boards beveled on one edge to about 40 deg. were mitered even with the inside edge of the form to give a beveled edge to the face of the work when done, as shown in the accompanying illustration.

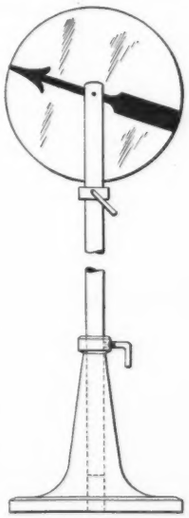
Next, I took a straight-edge and laid it across the front of the form and drove the insulating tubes even with the edge and cut the pins the same length. After the wood-work was done I laid the board on two timbers, face side up, and leveled it by a straight-edge laid across the sides of the form.

A concrete mixture of one part portland cement to three of fine sand, mixed thin enough to run freely, was poured in the form and allowed to set for a week or more. When it was thoroughly dry and hard, the form was removed and the wooden pins driven out through the cross-pieces. The concrete was bolted to the board with 5/8-in. bolts.

The fuse blocks, main switch and rheostat were then fastened in place with 1/4-in. bolts through the holes left by driving out the wooden pins. The wiring was mostly at the back of the board, the porcelain tubes serving as passages for making the necessary connections to the apparatus on the front. The back of the board was covered with sheet asbestos for safety and the wires were supported on porcelain cleats. All the conductors were thoroughly insulated from the wood and concrete parts, so that the work passed the underwriters' rules. Finally, the board was painted with a mixture of lampblack and linseed oil, which gave it the appearance of slate. The whole has a good appearance, as shown in the illustration and satisfies all concerned.

A Holder for Danger Signs

It is conceded by safety experts that the different-colored disk-shaped danger signs now used by many industrial concerns fill an important place as a means of preventing accidents, says J. E. Cooley in *American Machinist* of Sept. 2, 1915. One drawback found in using these is, there is not always a suitable place (or means) to hang or tack them up where a danger exists, and workmen are therefore exposed to hazards because no place is convenient to put up a sign, or it is too much trouble to provide means for this purpose.



A HOLDER FOR DANGER SIGNS

The illustration shows a danger-sign holder that can be moved about for temporary use or fastened to the floor and used in a permanent position. It is made so that it can be used anywhere and so constructed that the sign can be set to a point directly at the danger to be avoided.

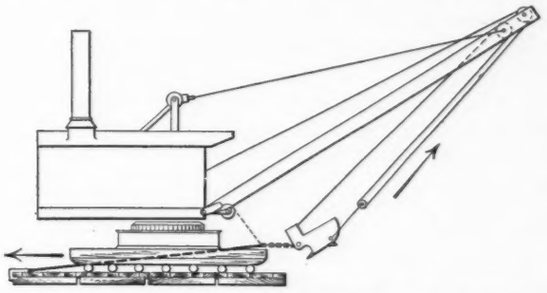
It consists of a cast-iron base, having an adjustable rod about 1/2 in. diameter, held in place with a binding-screw in the base. At the top of the rod an opening is sawed down a short distance through the center, in which to place the sign, which turns on a small pin, as shown. The binding-collar and screw near the top secures the sign in place, after the arrow-head is set to point at the danger to be avoided.

The use of these holders will prevent many accidents that would otherwise happen. Several of them should be made up and placed where they will be accessible at all times.

Moving a Dragline Excavator Over Soft Ground

An ingenious method is employed by the Winnipeg Aqueduct Construction Co., says the *Excavating Engineer*, for moving its dragline excavators over the soft material in which they are digging. The material is called muskeg, which is nothing but decayed moss and vegetable matter, so soft that it is impossible to get a firm hold with the bucket without digging from 4 to 6 ft. until clay is encountered. This operation naturally caused considerable delay. The following effective method was evolved to overcome this trouble.

The draglines operate on four platforms. When a machine is ready to move and the platform in the rear of the machine is swung and dropped in place in front



TACKLE FOR MOVING DRAGLINE EXCAVATOR

of the machine in the direction in which it is desired to move, the dragline is swung facing the rear. A 20-ft. chain, or better yet, a cable, is hooked by means of a clamp onto the platform which has just been dropped in front of the machine. This cable is run under the base of the machine and the other end is hooked through the bucket chain. When the bucket is hoisted, the machine moves ahead easily in the direction desired. With this method, the machine is ready to dig in five minutes.

Bonus-System Mucking

An instance of the effect of the bonus system on the industry of the men is given by S. P. Brown, chief engineer of the Canadian Northern-Montreal Tunnel and Terminal Construction. Seven muckers were employed in the heading under normal conditions, three in advance throwing the muck back from under the bar and the four other men loading on the cars direct. Mr. Brown says that normally a mucker thinks he is doing a good day's work when he shovels 7 cu.yd. of loose muck into a car, and that really this is all that can be expected of him.

During the record month at the Mount Royal tunnel, however, the four muckers who were loading on the cars handled up to 15 cu.yd. per man per shift, and averaged over 12 cu.yd. In order to appreciate that this is probably a mucking record, it must be remembered that nearly two hours were lost out of the eight in blasting, as two shots were fired regularly every shift. On this work a foreman never had to hire or discharge men during periods of rapid progress. If a man failed to do his share of the work, his comrades ran him out of the tunnel and brought in a better man to take his place.—*Engineering News.*

Details of Milling and Smelting

Corrosion of Iron Pans in Zinc Melting

In hot galvanizing the zinc is generally fused in iron pans, and the iron pans are attacked by the fused zinc, says *Engineering,* Aug. 20, 1915. If that were not so, mechanical galvanizing would hardly be efficient; for the zinc is to adhere to the iron, and it does adhere because it alloys to a certain extent with the iron. The iron pans in which the zinc is fused hence suffer, and the practice considers certain kinds of iron especially suitable for making iron pans. Two years ago the well-known establishment of Julius Pintsch, of Fürstenwalde, observed to its surprise that an iron pan, supplied by an English firm of repute, which had always given satisfaction, was more quickly corroded by the zinc than lower-grade iron pans. The fact was ascribed to a certain peculiarity in the iron, but a more thorough investigation of the problem was deferred.

The results of the subsequent investigation were published last May in the *Zeitschrift des Vereines Deutscher Ingenieure.* Sheets of 10 different kinds of iron were supplied by Krupp in Essen. After having been analyzed and examined metallographically, they were cut up into plates, and pairs of these plates were suspended for 8 hr. in molten zinc at different temperatures. All the plates lost in weight by being kept in contact with the molten zinc, the loss amounting to about 20 grams of iron per hour per square meter of iron surface in a well-heated bath; and as long as the temperature was not raised materially, the composition of the iron did not appear to make much difference.

An increase in the carbon percentage did not favor the corrosion, nor did a change in the manganese proportion. A rise in the phosphorus percentage from 0.025 to 0.090 did not affect the corrodibility either, though the introduction of phosphorus into the zinc bath is of course undesirable. An increase in the silicon percentage did increase the solubility of the iron noticeably, and want of homogeneity in the structure of the iron had the same effect. But these influences were not important, and the temperature of the bath proved of much greater consequence. Zinc melts at 419.4° C. As the temperature of the bath was slowly raised from about 437° C., at which the first observations were taken, the loss of iron increased slowly at first, but much more rapidly afterward, when the temperature exceeded 500° C. In one case the losses of weight were: 20 grams at 437°; 23 grams at 467°, 28 grams a 486°, 41 grams at 495°, 68 grams at 500°, and 288 grams at 532°, the loss being understood as before, per hour per square meter of iron surface. This was not the worst case. One iron lost over 500 grams, another 800 grams in the eighth hour. At higher temperatures, moreover, the differences between the different sorts of iron became much more pronounced.

The chief thing to guard against, then, is an unduly high temperature of the zinc bath. It was further observed that it is advisable to keep the pan, so far as possible, at fairly even temperatures, and to avoid repeated complete cooling and reheating, lest crusts of hard zinc should peel off and impair the iron locally.

Theory of the Bucket Elevator

By L. Kresser*

The discharge conditions of a belt elevator can be determined theoretically and in advance of construction. In Fig. 1 the circle C represents the head pulley or the circle described by the backs of the buckets of an elevator. Assume the diameter of this circle to be $2r$ and the circumferential speed v_0, then the centrifugal acceleration is $\frac{{v_0}^2}{r}$.

In a position of the bucket in which its back is inclined at angle a, as is indicated by line AB, a piece of material at A is subject to the action of gravity and of the centrifugal force $\frac{{v_0}^2}{r}$. The tangential component of the gravity is $g \times \sin a$ ($g = 32.19$ ft. per sec.^{2}), which is the driving force for the discharge of the material. The frictional resistance is $\left(g \times \cos a - \frac{{v_0}^2}{r}\right)\mu$, wherein $\mu = tg\,\varphi$ is the coefficient of friction between the material

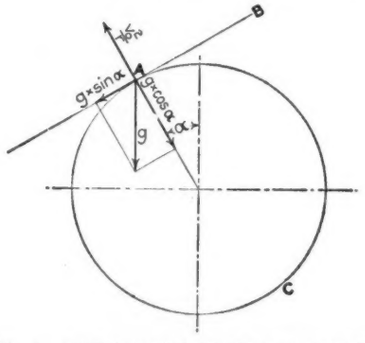


FIG. 1. PARALLELOGRAM OF FORCES, BUCKET ELEVATOR

and the bucket. Ejection of the material will take place as soon as $a = a_0$, a_0 to be determined from:

$$g \times \sin a_0 - \left(g \times \cos a_0 - \frac{{v_0}^2}{r}\right)\mu = 0$$

The acceleration for the motion of discharge of the material $p_t = g_4 \times \sin a - \left(g \times \cos a - \frac{{v_0}^2}{r}\right) \times \mu$.

The velocity is:

$$v_t = \int p t dt;\ put\ a = K \times t \text{ where } K = \frac{v_0}{r}$$

*Mechanical engineer, Passaic, N. J.

$$v_t = \frac{1}{K} \times \left[g \times \cos a_0 + \mu \times g \times \sin a_0 - \mu \frac{{v_0}^2}{r} a_0 - \left(g \times \cos a + \mu \times g \times \sin a - \frac{{v_0}^2}{\mu r} a \right) \right]$$

For an angle of $a = a'$ this velocity is: v_t'.

wherein a' is determined by: $g \times \cos a' = \frac{{v_0}^2}{r}$

For an angle $a > a'$ the acceleration is $p_t = g \times \sin a$ and the velocity $v_t = \frac{1}{K} \times \left[g \times (\cos a' - \cos a) \right] + v_t'$

However, more important than the velocity is the discharge of the material which is: $s_t = \int v_t \times dt$.

$$s_t = \frac{1}{K^2} \times \left[\left(g \times \cos a_0 + \mu \times g \times \sin a_0 - \mu \times \frac{{v_0}^2}{r} - a_0 \right) (a - a_0) + g \times (\sin a_0 + \mu \times \cos a) - g \times (\mu \times \cos a_0 + (\sin a + \frac{\mu}{2} \times \frac{{v_0}^2}{r} \times ({a}^2 - {a_0}^2) \right] \quad For\ a \leq a'$$

For angle $a = a'$ is the displacement s_t' and for angles $a > a'$ $s_t = s_t' + \frac{1}{K^2} \times \left[g \times (a - a') \times \cos a' - g \times (\sin a - \sin a') + v_t' K \times (a - a') \right]$

The result of this complicated formula has been plotted in the charts of Figs. 2, 3, 4 and 5, which are figured for a value of $k = 1$, and any displacement taken from it is to be divided by the square of the angular velocity. The four charts are figured for coefficients of friction $\mu = 0.2$, 0.4, 0.6 and 0.7. Each curve is drawn for a certain value of the centrifugal acceleration as a fraction of the acceleration of gravity. Values of $\frac{{v_0}^2}{r} = 0.1 \times g$ up to $\frac{{v_0}^2}{r} = 1.0 \times g$ include all slow- and fast-running elevators. By means of the chart it is possible to determine the angle at which a complete discharge of the material from the bucket has taken place.

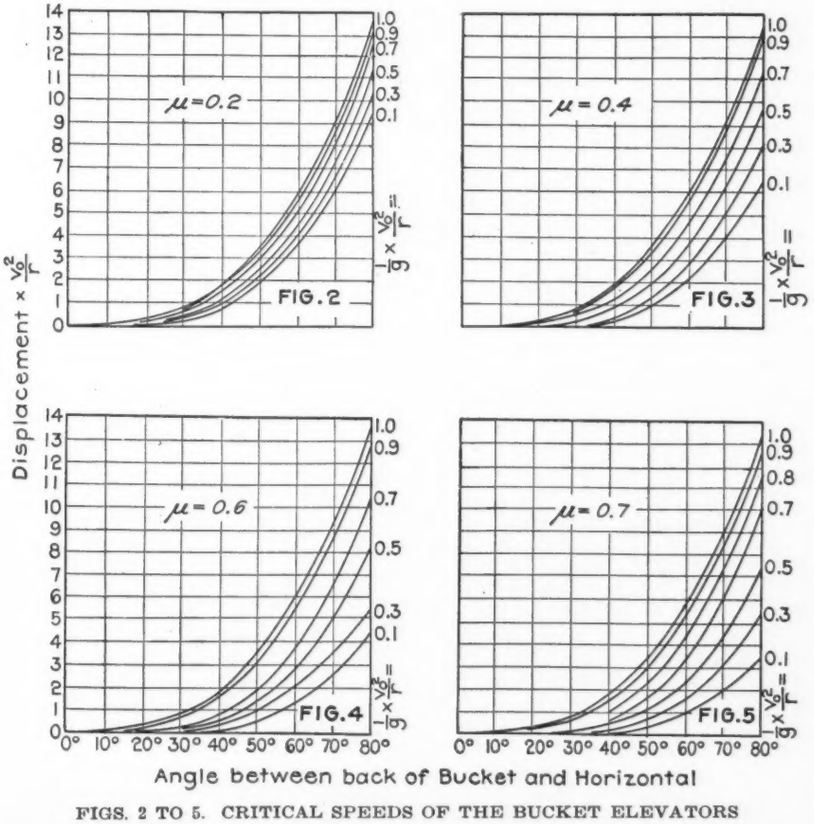
Example: Material: Hard coal $\mu = 0.6$. Size of bucket, 12x6x6. Speed of elevator, 360 ft. per min., or 6 ft. per sec. Diameter of head pulley, 40 in., or $r = 1.66$ ft.

$$\frac{{v_0}^2}{r} = \frac{36}{1.66} = 21.7 \text{ and } \frac{{v_0}^2}{r} \times \frac{1}{g} = 0.674;$$

$$\frac{v_0}{r} = K = 3.61; \left(\frac{v_0}{r} \right)^2 = 13.03$$

For a displacement of 6 in. the chart value is $13.03 \times 0.5 = 6.5$ ft.

We find in the chart for $\mu = 0.6$ a curve somewhat below $\frac{{v_0}^2}{r} = 0.7 \times g$ and reach a displacement of 6.5 ft. at about 70°. If we should prefer an earlier discharge at the same speed we have to use a larger head pulley, for instance, of 52 in. diameter, and the discharge will be complete at an angle of 64°. If we run this elevator with a 40-in. pulley at a speed of 180 ft. per min., or 3 ft. per sec., the discharge will be complete at an angle of 52°.



FIGS. 2 TO 5. CRITICAL SPEEDS OF THE BUCKET ELEVATORS

Hall Sulphur Reduction Applied to Blast Furnaces

The Hall process for the recovery of elemental sulphur has been applied to blast-furnace smelting (U. S. pat. 1,134,846). A reducing flame is introduced at about the normal level of the top of the charge, while the charge is put in through openings which are normally sealed, just as in iron smelting. The reducing flame decomposes the SO_2, while the shutting out of the oxygen ordinarily admitted through the charge doors gives the sulphur no chance to reoxidize. Therefore it passes out of the furnace as sublimed sulphur and is recovered in a gas washer.

Colley Briquetting Process

An ingenious method for rendering ores suitable for blast-furnace treatment is the one patented by Bernard T. Colley, of Rancagua, Chile (U. S. pat. 1,098,883). His process consists in taking the sulphur dioxide from the roasters for the manufacture of sulphuric acid (20% or stronger). This acid is then thoroughly mixed with crushed limestone and agitated, producing calcium sulphate. This calcium sulphate to the extent of 5% is then mixed with the roasted ore, where it exercises the same briquetting power that plaster of paris would.

The Cost of Doing Things

Cost of Mining in Alaska

The figures herewith give details of mining costs at the Alaska Treadwell Gold Mining Co., the Alaska United Gold Mining Co. and the Alaska Mexican Gold Mining Co., Douglas Island, Alaska, for 1914, as shown by their annual reports.

A summary of the table for the Alaska Treadwell shows that the total cost of producing 910,285 tons of ore, 608,794 tons of which were drawn from the broken-ore reserve, was 68.9c. per ton for mining. This cost is made up of 5934 ft. of development at $17.753 per ft.;

DEVELOPMENT COSTS PER FOOT

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Machine drillers	$5.749	$0.638	$1.959	$1.183
Hand miners	....	....	.175	.007
Laborers	2.370	.244	1.063	.560
Powdermen	.063	....	.008	....
Foremen, shift bosses	.418	.353	.213	.536
Machinists, pipemen	.125	....	....	.001
Carpenters, timbermen	.579	....	.228	.183
Contractors	1.304	5.676	2.607	.337
Engineers, oilers and skipmen	.052	....	....	....
Cagemen	.016	....	....	....
Trainmen and trammen	.034	....	....	....
Track and stablemen	.080	....	....	.003
Timekeeper	.174	....	....	....
Total direct labor	$10.964	$6.911	$6.253	$2.810
Powder	$1.817	$1.829	$1.173	$0.598
Primers	.393	.297	.181	.098
Candles	.007	....	....	....
Machine drill supplies	.574	.390	.003	.009
Drill steel	.524	.184	.009	.025
Lumber and timber	.496	.287	.109	.147
Lubricants	.014	.017	....	....
Carbide	.024	....	.007	.002
Miscellaneous	.421	.337	.093	.118
Total direct supplies	$4.270	$3.341	$1.575	$0.997
Electrical repairs	$0.031	$0.025	....	....
Mechanical repairs	.224	.034	$0.007	$0.014
Power	.008	.001	....	....
Train service	.098	.054	.013	.053
Assaying	.016	.040	.014	.002
Surveying	.056	.111	.060	.040
General expense	1.551	.506	.566	1.068
Steam heat	.053	....	....	....
Compressed air	1.219	.932	.647	.372
Blacksmith shop	.773	.676	.606	.354
Diamond drilling	1.244	1.154	.352	.079
Central development	5.575	....	1.089	2.990
By Treadwell Co.	....	....	3.611	6.529
By United Co.	....	....	....	.388
Total mixed labor and supplies	$10.848	$3.533	$6.965	$11.889
Grand total	$26.082	$13.785	$14.793	$15.696
Credits	8.329	....	.134	....
Net total cost	$17.753	$13.785	$14.659	$15.696
Feet of development	5,934	3,569	8,528	2,952

stoping 301,491 tons at $1.050 per ton, tramming 910,285 tons at 11.6c. per ton, hoisting 910,285 tons at 9.4c.; and pumping at 1.6c. per ton. These costs consist of 33.8c. for labor, 19.6c. for supplies, and 21.2c. for subsidiary accounts; less 5.7c. per ton for credits. No depreciation is charged in these figures.

The cost of mining on the Ready Bullion claim of the Alaska United was $1.055 per ton for 233,100 tons exclusive of depreciation. Included in this cost is 3569 ft. of development at $13.785 per ft., stoping 249,545 tons at 51.3c. per ton, tramming 233,100 tons, 12.2c.; hoisting 233,100 tons, 13.9c.; and pumping, 3.4c. per ton. These costs consist of 59.8c. for labor, 23.2c. for supplies and 22.5c. for subsidiary accounts. Costs at the 700-Ft. claim amounted to $1.23 for 225,214 tons, of which 106,002 tons were stoped and the remainder was drawn from broken-ore reserves. The cost was made up of 8528 ft.

STOPING COST PER TON OF ORE STOPED

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Machine drillers	$0.172	$0.098	$0.138	$0.124
Hand miners	.032	.018	.034	.037
Laborers	.219	.136	.238	.241
Powdermen	.029	.008	.029	.020
Trainmen, trammen	....	....	....	.004
Trackmen, stablemen	.001	....	....	.001
Pumpmen	....	....	....	.002
Foremen, shift bosses	.021	.026	.037	.021
Machinists, pipemen	.002	.005	.002	.004
Carpenters, timbermen	.002	.010	.005	.018
Timekeeper	.003	....	....	....
Chutemen	....	....	....	.006
Total direct labor	$0.481	$0.301	$0.483	$0.478
Powder	$0.317	$0.077	$0.169	$0.114
Primers	.087	.026	.052	.034
Candles	.005	.002	.003	.002
Machine drill supplies	.020	.014	.020	.015
Lumber and timber	.004	.003	.007	.005
Lubricants	.001	.001	.002	.001
Carbide	.002	.002	.002	.002
Miscellaneous	.009	.006	.011	.005
Drill steel	....	.007	.016	.010
Total direct supplies	$0.447	$0.138	$0.282	$0.188
Electrical repairs	$0.002	....	....	$0.002
Mechanical repairs	.001	....	....	.001
Train service	.001	$0.001	$0.001	.001
Assaying	.003	.002	.004	.003
Surveying	.001	.001	.001	.001
General expense	.069	.022	.034	.064
Steam heat	.003	.002	.004	.003
Compressed air	.024	.027	.037	.034
Blacksmith shop	.018	.019	.036	.034
Total mixed labor and supplies	$0.122	$0.074	$0.117	$0.143
Total cost stoping	$1.050	$0.513	$0.882	$0.809
Tons stoped	301,491	249,545	106,002	167,274

TRAMMING COST PER TON OF ORE TRAMMED

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Laborers	$0.042	$0.055	$0.046	$0.035
Engineers, oilers, skipmen	.001	....	.008	.006
Chutemen	.017	.014	.017	.021
Trainmen, trammen	.013	.014	.013	.017
Trackmen, stablemen	.003	.005	.005	.007
Foremen, shift bosses	.003	.005	.005	.006
Carpenters, timbermen	.002	....	....	....
Machine drillers	....	.001	....	....
Powdermen	....	....	.001	....
Machinists, pipemen	....	....	.002	.001
Total direct labor	$0.081	$0.094	$0.097	$0.093
Steel rope	$0.001	....	....	....
Lumber and timber	.001	....	....	....
Electric motor	.004	....	....	....
Stable	.001	$0.003	$0.003	$0.003
Miscellaneous	.003	.012	.005	.002
Lubricants	....	....	.001	.001
Total supplies direct	$0.010	$0.015	$0.009	$0.006
Electrical repairs	$0.006	$0.001	$0.001	$0.002
Mechanical repairs	.003	....	.006	.003
General expense	.012	.007	.007	.012
Compressed air	.002	....	.003	.002
Electric lights	.001	.001	.001	.002
Blacksmith shop	.002	.004	.004	.003
Central tramming	.001	....	.001	.001
Train service	....	....	....	.001
By Treadwell Co.	....	....	....	.002
Total mixed labor and supplies	$0.027	$0.013	$0.023	$0.028
Credits	.002	....	....	....
Total cost tramming	$0.116	$0.122	$0.129	$0.127
Tons trammed	910,285	233,100	225,214	233,457

of development at $14.659 per ft., stoping 106,002 tons at 88.2c. per ton, tramming 225,214 tons at 12.9c., hoisting 225,214 tons at 11.9c. and pumping, 1.2c. per ton.

These costs consisted of 59.5c. for labor, 40.4c. for supplies and 43.1c. for subsidiary accounts.

Mining costs at the Alaska Mexican amounted to $1.019 per ton for 233,457 tons, exclusive of depreciation. Of this tonnage 167,274 tons were stoped and the remainder was drawn from broken-ore reserves. This cost was made

COST OF HOISTING PER TON HOISTED

	Alaska Treadwell	Alaska United Ready Bul.	Alaska United 700-Ft. Claim	Alaska Mexican
Engineers, oilers, skipmen	$0.017	$0.048	$0.021	$0.027
Cagemen	.003	....	.007	.009
Carpenters, timbermen	.001	.006	....	....
Laborers	....	.001	....	....
Trackmen, stablemen	....	.005	....	....
Total direct labor	$0.021	$0.060	$0.028	$0.036
Steel rope	$0.001	$0.005	....	....
Lumber and timber	.001	.001	....	....
Miscellaneous	.002	.006	.003	....
Lubricants	....	.002	....	$0.001
Total direct supplies	$0.004	$0.014	$0.003	$0.001
Electrical repairs	$0.002	$0.001	....	....
Mechanical repairs	.004	.005	$0.004	$0.004
Power	.030	.048	.024	.043
General expense	.002	.004	.003	.005
Steam heat	.001	.004	....	....
Blacksmith shop	.001	.002	.002	.001
Central hoisting	.030	....	.038	.019
Building repairs	....	.001	.002	.002
Rental of equipment	....	....	.015	....
By Treadwell Co.	....	....	....	.001
Total mixed labor and supplies	$0.070	$0.065	$0.088	$0.075
Credit	.001	....	....	.016
Total hoisting cost	$0.094	$0.139	$0.119	$0.096

up of 2952 ft. of development at $15.696 per ft.; stoping 167,274 tons at 80.9c. per ton; tramming 233,457 tons at 12.7c.; hoisting 233,457 tons at 9.6c. and pumping 1.7c. per ton. The charge for labor included in these costs was 51.3c. per ton; supplies, 15.4c.; subsidiary accounts, 35.2c. per ton.

Dredging and Hydraulicking Operations in the Yukon

The following data were taken from the report of the Yukon Gold Co. for 1914. At Dawson the dredges began operations on May 12 and ran until Oct. 23. The average length of the dredge season was 164 days, during which the dredges operated 87.2% of the possible time. The thawing cost was reduced 1.39c. per cu.yd. and was lower than for any previous season. A total of 421,835 sq.yd., or 68.6% of the ground handled, was frozen and had to be thawed by steam. The dredges handled 4,800,781 cu.yd. of material, which produced $2,602,685, or 54.21c. per cu.yd., at a working cost of 27.62c. per cu.yd.

The Iditarod dredge operated from May 4 to Nov. 11 and handled 668,737 cu.yd. of material, producing $739,631, or $1.10 per cu.yd. The operating cost, including $50,000 depreciation, was 50.2c. per cu.yd., with the dredge operating 91.91% of the possible time. The maximum grade of the creek did not exceed 5% and few boulders were encountered, but large quantities of granitic sand were handled. A total of 67,260 sq.yd. of ground, or 74% of the total area, was thawed by steam.

The three California dredges operated by the Pacific Co. handled 3,198,192 cu.yd. of gravel and produced $322,571. The average cost of the three dredges was 4.27c. per cu.yd., including depreciation.

The hydraulic operations at Dawson handled 3,241,641 cu.yd. of material at a working cost of 7.6c. per cu.yd., exclusive of depreciation of the main ditch. The total amount of water used amounted to 519,834 miner's inches, equal to a duty of 6.02 cu.yd. per miner's inch.

Cost of the Belmont Mill*

The Belmont mill at Tonopah, Nev., was designed and constructed by the Belmont staff. Ground was broken in August, 1911, and milling operation started July 25, 1912. The metallurgical flow-sheet and the machinery adapted to carrying out operations in accordance with this plan were decided upon from experience gained in the treatment of Belmont mine ores at the old Belmont mill at Millers, Nev.

Detail drawings were made by the engineering staff of the Tonopah-Belmont Development Co. under the supervision of Otto Wartenweiler, who also had direct charge of the construction, consulting with the general superintendent of the company, Frederick Bradshaw, and A. H. Jones, superintendent of milling.

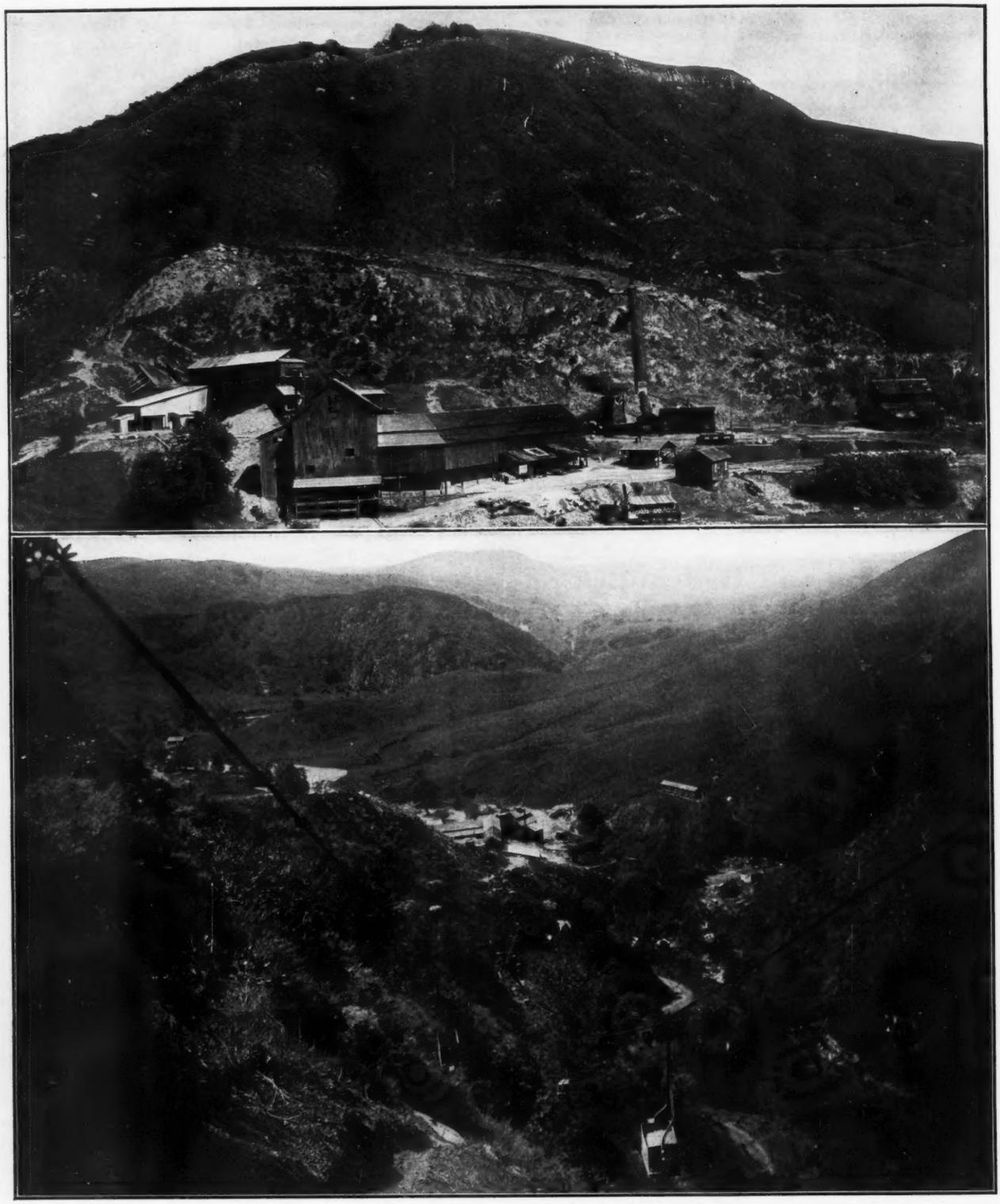
The total cost of the plant, designed to handle 500 tons per day, was $465,189.07. The savings in operating costs and increased extraction, as compared with the best results from the old mill at Millers, were such as to return the entire cost of the new plant from the treatment of 260,000 tons of ore, or approximately 18 months' operation. The accompanying table shows the costs of construction.

CONSTRUCTION COSTS, BELMONT MILL

	Excavation, Concrete Walls and Foundations	Floors and Machinery Foundations	Buildings: Frames	Buildings: Covering	Machinery, Including Erection, Piping, Belting, Etc.	Totals
Crusher plant	$5,760.72	$2,527.58	$2,230.72	$1,476.69	$21,174.96	$33,170.67
Inclined conveyor	166.41	238.02	1,771.75	585.19	3,620.79	6,382.16
Battery bins	399.00	489.70	.....	2,067.69	3,475.14	6,431.53
Stamps	.....	8,797.82	.....	.....	36,873.06	45,670.88
Tube mills and classifiers	.....	3,180.95	.....	.....	40,127.89	43,308.84
Callow cones	.....	26.02	.....	.....	856.63	882.65
Concentrating plant	.....	1,663.23	.....	.....	11,356.35	13,019.58
Concentrate house	76.80	449.69	354.80	623.27	602.10	2,106.66
Dorr thickeners	.....	11,297.98	.....	.....	15,034.53	26,332.51
Circulating system	.....	147.81	.....	.....	6,846.05	6,993.86
Air agitation	261.71	3,987.80	.....	.....	25,257.89	29,507.40
Clarifying	.....	1,829.63	.....	.....	8,573.87	10,403.50
Precipitation system	395.00	44.05	.....	.....	29,581.02	30,020.07
Briquetting plant	.....	.....	.....	.....	1,589.49	1,589.49
Air compressor	.....	1,084.39	.....	.....	7,094.52	8,178.91
Filter plant	.....	4,456.68	.....	.....	30,104.50	34,561.18
Refinery	2,473.84	1,552.23	2,200.17	2,292.80	7,548.79	16,067.83
Boiler plant and fuel-oil system	571.56	90.97	401.25	531.11	7,606.28	9,201.17
Tank-heating system	.....	9.56	.....	.....	3,362.39	3,371.95
Transformer house	91.83	101.05	428.69	213.07	4,804.89	5,639.53
Lime house	11.00	.....	.....	753.30	305.85	1,070.15
Machine shop	1,297.66	843.01	1,138.73	1,191.93	339.36	4,810.69
Storeroom	511.55	1,509.60	1,305.84	1,315.78	152.04	4,794.81
Inclined railway	133.25	.....	432.70	203.41	379.51	1,148.87
Mill building	39,645.45	6,757.60	45,493.48	19,607.14	9,020.51	120,524.18
Total	$51,795.78	$51,085.37	$55,758.13	$30.861.38	$275,688.41	$465,189.07

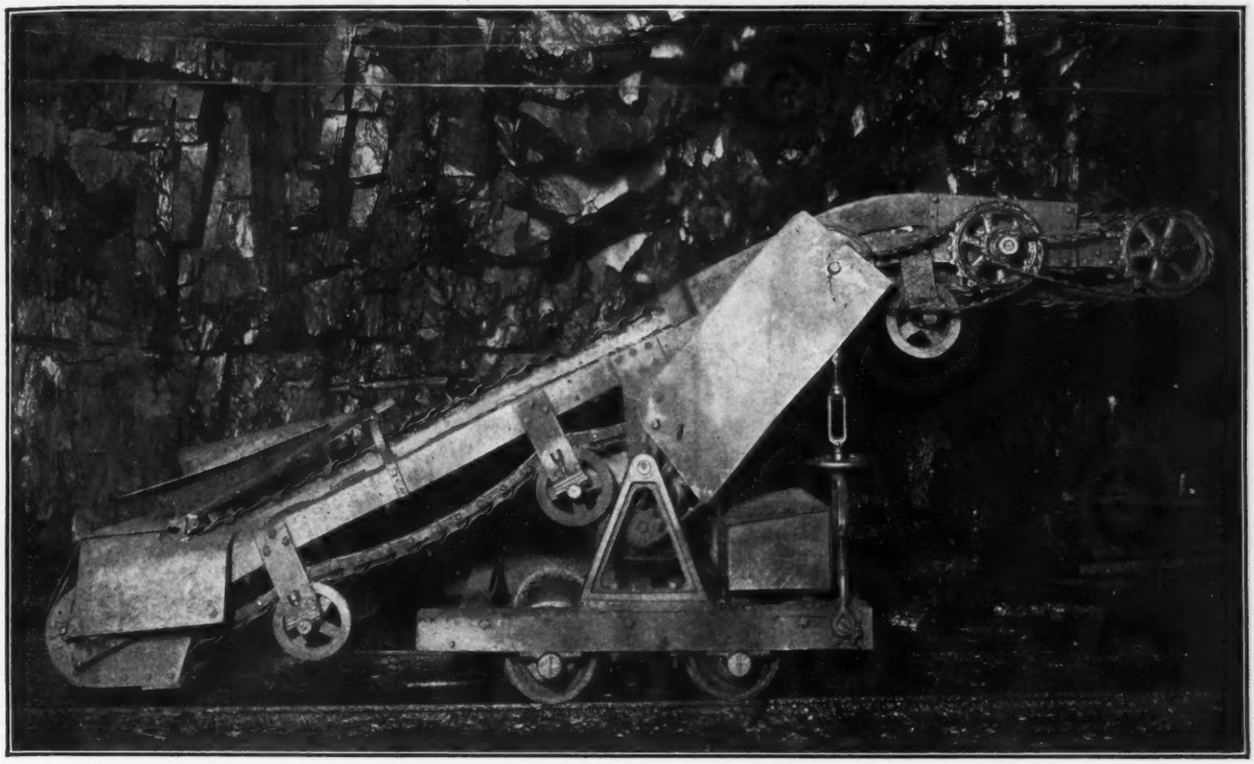
*From an article by A. H. Jones in "Bulletin," A. I. M. E., August, 1915.

Photographs from the Field



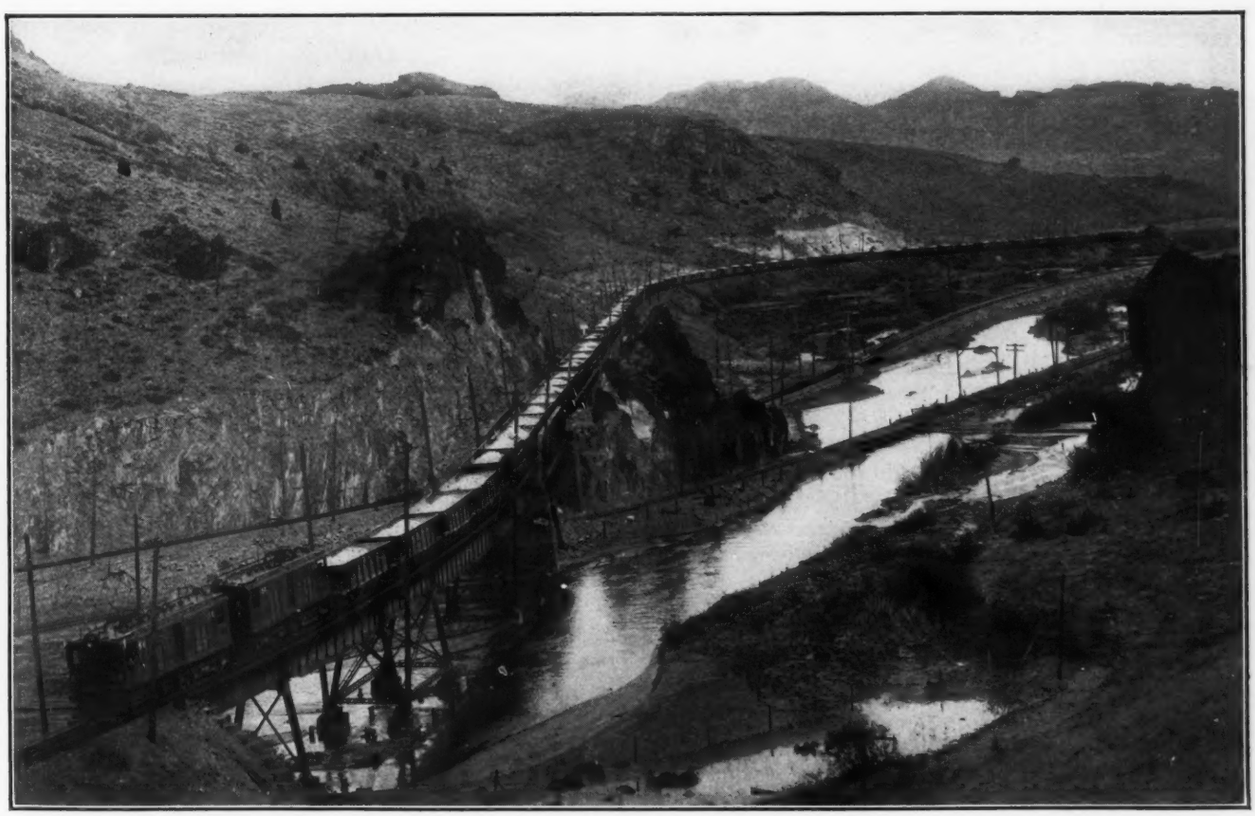
OCEANIC QUICKSILVER MINE, NEAR CAMBRIA, CALIF.

Upper view shows the mine. Lower view shows the aërial tramway used to convey ore from the mine to the furnace plant



PORTABLE LOADING MACHINE AT THE MORRIS-LLOYD MINE OF THE CLEVELAND-CLIFFS IRON CO.

The muckers shovel into the lower end of the machine, rock being then elevated on a steel-apron conveyor belt and dumped into 3-ton saddle-back cars. A 30% increase of efficiency over simple shoveling was gained



LONG ORE TRAIN, CONTAINING 75 CARS, ON THE BUTTE, ANACONDA & PACIFIC RY. IN SILVER BOW CANYON, MONT.

At this place the Anaconda railway crosses two transcontinental lines—the Northern Pacific and the Chicago, Milwaukee & St. Paul—both of which are shown in the picture

Correspondence and Discussion

Securities of the American Smelting and Refining Co.

The able review of the securities of the American Smelting and Refining Co. and its subsidiary, the American Smelters Securities Co., in the editorial columns of the *Journal* of Aug. 28 has been read by me with much interest.

The answer to the inquiry as to "why one of the premier securities of so solid a company should be available at so low a price" is that in this case the American investor is profiting temporarily by the necessities of his unfortunate European brother. A large part of this issue was originally sold abroad, and the enormous financial requirements of the European War have compelled investors in the belligerent countries to dispose of some of their holdings of sound American investment securities at prices materially below their intrinsic worth; in this respect the market quotations for American Smelters Securities preferred shares, series A, have been particularly affected.

In connection with the table showing the comparative yields of the securities of the American Smelting and Refining Co. and its subsidiary, the inclosed comparison between American Smelting and Refining preferred and American Smelters Securities preferred, series A, will no doubt be of some interest.

STATISTICS OF AMERICAN SMELTERS SECURITIES PREFERRED STOCK A

	American Smelting and Refining Co. Preferred Stock, 7% Cumulative	American Smelters Securities Co. Preferred Stock, Series A, 6% Cumulative
Price	106	85
Yield	6¼%	7.06%
Number of times preferred dividend was earned—		
Calendar year 1914	1.9	3.8
Calendar year 1913	2.1	4.4
Average from May, 1905, to Dec. 31, 1914	2.35	3.7

American Smelters Securities preferred stock, series A, has the provision for the retirement of the stock at 100 by lot under the operation of the cumulative annual sinking fund, by which the entire issue should be retired by 1947. The holder of the stock purchased at present prices should therefore receive a profit of $15 per share on his investment, and the profits derived from such redemption will form a considerable addition to the dividend yield.

A comparison of the earnings of the two companies over a series of years shows that the dividend requirements of the latter stock are protected by a materially larger margin of earning power than those of the former; the position of Smelters A is therefore better from an investment standpoint.

The opportunity for material profit through the retirement of the shares at par under the operation of the sinking fund is a feature not possessed by any of the other securities of the American Smelting and Refining Co. or its subsidiary. While the present value of this profit through retirement to any individual investor depends upon the date on which the shares are drawn, the provision is a valuable one and should entitle these shares to a market valuation materially above others equally well secured but lacking this feature.

I am pleased to note a review of securities of this class in the editorial columns of the *Journal,* because it is in the interest of sound mining finance, upon which sound mining operations are necessarily dependent.

EUGENE MEYER, JR.

New York, Aug. 28, 1915.

[The fact remains that in any inter-company dealings to the advantage of the A. S. & R. Co. as against the A. S. S. Co., the latter's preferred A stock is the only one of its issues that could be hurt, barring the common, and that is all owned by the American Smelting and Refining Co.—Editor.]

Holmes Professorship, Colorado School of Mines

On Aug. 12 the Board of Trustees of the Colorado School of Mines created the Joseph A. Holmes Professorship of Safety and Efficiency Engineering, in honor of the late Doctor Holmes, Director of the United States Bureau of Mines.

I was authorized by the board to nominate persons suitable for this position, and we are enabled to offer a salary that would induce a first-class man, trained in such work, to come here. I would therefore be greatly obliged for suggestions as to filling this position.

The specific object of this professorship is to train our students in the use of all life-saving apparatus and in all matters that would be embraced under the general term of safety and efficiency engineering, in so far of course as they may be separated from other work of a similar character.

I believe that this is the first and only professorship of the sort in the United States, and naturally we have to feel our way along a bit. We would like to have the man chosen for the position devote himself, for the next few months, to becoming acquainted with conditions here if he does not already know them, so that he may himself be able to outline the proper course of instruction.

We have felt that there could be no more fitting memorial to Doctor Holmes than the establishment and maintenance of this professorship to bear his name, and surely we must see to it that it is conducted in a manner that he would approve of. One cannot, of course, say offhand just how many and what subjects should be embraced under the general term "safety and efficiency engineering"; but we are resolved to work this problem out according to our best lights and to do this we must have a first-class man in charge of the chair. A modern equipment will be provided and kept uptodate, and we hope to have this chair stand for all that is best in safety engineering.

WILLIAM B. PHILLIPS,
President, Colorado School of Mines.

Golden, Colo., Aug. 28, 1915.

NEW PUBLICATIONS

COAL FIELDS OF BRITISH COLUMBIA. Compiled by D. B. Dowling. Pp. 350, illus. Memoir 69, Canadian Department of Mines, Geological Survey Branch, Ottawa.

A LIST OF CANADIAN MINERAL OCCURRENCES. By Robt. A. A. Johnston. Pp. 275. Memoir 74, Canadian Department of Mines, Geological Survey Branch, Ottawa.

THE FAUNA OF THE BATESVILLE SANDSTONE OF NORTHERN ARKANSAS. By George H. Girty. Pp. 170, illus. Bull. 593, U. S. Geological Survey, Washington.

RECONNAISSANCE OF THE GEOLOGY AND OIL PROSPECTS OF NORTHWESTERN OREGON. Chester W. Washburne. Pp. 111, illus. Bull. 590, U. S. Geological Survey, Washington.

PETROLEUM AND NATURAL GAS RESOURCES OF CANADA. In two volumes; Vol. 1. By Frederick G. Clapp and Others. Pp. 378, illus. Canadian Department of Mines, Ottawa.

THE MINERAL RESOURCES OF TEXAS. By William B. Phillips, Director, Bureau of Economic Geology and Technology. Pp. 362, illus. Bull. 365, University of Texas, Austin, Tex.

WESTERN AUSTRALIA—ANNUAL PROGRESS REPORT OF THE GEOLOGICAL SURVEY FOR THE YEAR 1914. With an Index Map. Pp. 41, illus. Western Australia Geological Survey, Perth.

ANTICLINAL STRUCTURE IN PARTS OF COTTON AND JEFFERSON COUNTIES, OKLAHOMA. By Carroll H. Wegemann. Pp. 108, illus. Bull. 602, U. S. Geological Survey, Washington.

GEOLOGY AND MINERAL RESOURCES OF KENAI PENINSULA, ALASKA. By G. C. Martin, B. L. Johnson and U. S. Grant. Pp. 243, illus. Bull. 587, U. S. Geological Survey, Washington.

REPORT ON THE NON-METALLIC MINERALS USED IN THE CANADIAN MANUFACTURING INDUSTRIES. By Howells Frechette. Pp. 221. Canadian Department of Mines, Ottawa, Canada.

CANADA—SUMMARY REPORT OF THE GEOLOGICAL SURVEY DEPARTMENT OF MINES FOR THE YEAR 1914. Pp. 201, illus. Canadian Department of Mines, Geological Survey Branch, Ottawa.

AN INVESTIGATION OF IOWA FIRE CLAYS. By Milton F. Beecher. Pp. 117, illus. Bull. 40, Engineering Experiment Station. Iowa State College of Agriculture and Mechanic Arts, Ames, Iowa.

REPORT ON MINING OPERATIONS IN THE PROVINCE OF QUEBEC DURING 1914. Theo C. Denis, Supt. of Mines. Pp. 151, illus. Department of Colonization, Mines and Fisheries, Quebec, Canada.

RESULTS OF THE INVESTIGATION OF SIX LIGNITE SAMPLES OBTAINED FROM THE PROVINCE OF ALBERTA. By B. F. Haanel and John Blizard. Pp. 110, illus. Canadian Department of Mines, Mines Branch, Ottawa.

RAPPORT SUR LES OPERATIONS MINIERES DANS LA PROVINCE DE QUEBEC DURANT L'ANNEE 1914. Pp. 150, illus. Division des Mines, Ministere de la Colonisation, des Mines et des Pecheries, Quebec, Canada.

ANALYSES OF ROCKS AND MINERALS FROM THE LABORATORY OF THE UNITED STATES GEOLOGICAL SURVEY, 1880 TO 1914. Tabulated by F. W. Clarke. Pp. 376. Bull. 591, U. S. Geological Survey, Washington.

GUIDEBOOK OF THE WESTERN UNITED STATES. Part A. The Northern Pacific Route with a Side Trip to Yellowstone Park. By Marius R. Campbell and Others. Pp. 212, illus,; $1. Bull. 611, U. S. Geological Survey, Washington.

EXTRACTS FROM REPORTS ON THE DISTRICT OF UNGAVA RECENTLY ADDED TO THE PROVINCE OF QUEBEC UNDER THE NAME OF THE TERRITORY OF NEW QUEBEC. Pp. 208, illus. Department of Colonization, Mines and Fisheries, Mines Branch, Quebec.

A STUDY OF METHODS OF MINE VALUATION AND ASSESSMENT, WITH SPECIAL REFERENCE TO THE ZINC MINES OF SOUTHWESTERN WISCONSIN. By W. L. Uglow. 6½x9½, pp. 73, illus. Wisconsin Geological and Natural History Survey, Madison, Wis.

ANNUAL REPORT OF THE BRITISH COLUMBIA MINISTER OF MINES FOR THE YEAR ENDING December 31, 1914. Being an Account of Mining Operations for Gold, Coal, Etc., in the Province of British Columbia. 6½x10½, pp. 544, illus. Richard McBride, Minister of Mines, Victoria, B. C.

QUEENSLAND—ANNUAL REPORT OF THE ACTING UNDER SECRETARY FOR MINES. Including the Reports of the Wardens, Inspectors of Mines, Government Geologists and Other Officers, for the Year 1914. Pp. 227, illus. Anthony James Cumming, Government Printer, Brisbane.

CHEMICAL GERMAN. An Introduction to the Study of German Chemical Literature. By Francis C. Phillips. Second edition, 5½x8¾, pp. 252, illus.; $2. Chemical Publishing Co., Easton, Penn.

A new edition, enlarged by 12 pages, of a well-known book.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF METALS, Vol VIII. Edited by Charles Vickers. 5¾x8¾, pp. 394, illus. American Institute of Metals, Buffalo, N. Y.

Contains the proceedings of the meeting of September, 1914, the papers read thereat, and the reports of the officers and committees.

STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS. By Frank F. Fowle. 4x6½, pp. 1984, illus., leather; $5. McGraw-Hill Book Co., New York.

This has been so greatly amplified as to be almost a new publication. It is an indispensable guide to the practising engineer and a valuable supplement to the standard text books. The various sections of the book are prepared by specialists in the fields treated, and the whole then edited by Mr. Fowle.

FINANCING AN ENTERPRISE. A Manual of Information and Suggestion for Promoters, Investors and Business Men Generally. By Francis Cooper. Fourth Edition. $3 postpaid. 5¼x8, pp. 524. The Ronald Press Co., New York.

The usual impression is that any meritorious enterprise can readily find the money for financing it. This book is intended to correct the ordinary idea and to show how to present any proposition in such a way as to obtain it a favorable hearing, and how to choose among the various ways that are open when financial support has been promised. A good book for the investor, promoter and examining engineer.

REPORT OF THE ROYAL COMMISSION ON MINING INDUSTRY AT BROKEN HILL IN THE STATE OF NEW SOUTH WALES. 11¼x13, pp. 862; board covers, 20s. William Applegate Gullick, Government Printer. Sydney.

Report by the commission appointed by the Governor to make inquiry into the advisability of providing, in connection with the various mines in the Broken Hill district of New South Wales, for the abolition of piece work, with a view to making mining work healthier and safer; the reduction of the temperature in the mine workings to 75° F., and if this be impracticable, a reduction in the hours of work in proportion to the increased temperature of the mine concerned; the compensation of employees by mining companies in all cases of industrial sickness or accidents, and the compensation of the relatives or dependents of employees who have lost their lives through sickness or accident; the improved ventilation of said mines; the authorizing of officials of industrial unions to visit any of the said mines or any working places in connection therewith, and to examine the pence-cards with a view to preventing the employment of non-unionists; and the prevention of the wholesale influx into Australia of foreigners unable to speak the English language; as to the best means of insuring a diminution in the number of accidents generally in the said mines; and concerning the provisions of means of exit from the mines in the case of fire, and generally as to the safe working of the mine.

The commission included a member of the Amalgamated Miners' Association, who, in various instances, made minority reports of the various findings.

CATALOG OF TECHNICAL PERIODICALS OF THE LIBRARIES IN THE CITY OF NEW YORK AND VICINITY. Compiled and Edited by Alice Jane Gates, Assistant Librarian of the Engineering Societies, with the coöperation of a committee of the New York Library Club. 8x10, pp. 110; $3. Library Board of the United Engineering Societies, New York, N. Y.

This volume, number one of the bibliographical contributions of the Library of the Engineering Societies is a worthy beginning of a promising series. It is a valuable catalog, or rather a directory, of the technical periodicals and engineering society transactions in or near New York City. It is as valuable to an individual as it is to libraries, in that an engineer, by referring to it, may readily locate a periodical reference in his research notes. The seven large and representative libraries contained in the catalog are: Columbia University Library, Chemists' Club Library, Library of the American Society of Civil Engineers, Library of the Engineering Societies, New York Public Library, Plainfield Public Library, and Library of Stevens Institute of Technology.

The catalog is a great step in a country-wide plan to record effectively the periodicals throughout the various cities, and is the outgrowth of a suggestion made by the late Dr. John Shaw Billings to W. P. Cutter, the librarian. The attempt was made to have a complete record of foreign and domestic periodicals, i.e., to include all changes of title, consolidations, record of indexes published, and suspension or cessation of publication. In short, it aims to be a concise history of every important technical periodical. The entries in the pages are compiled in an original and pleasing manner. The names of the periodicals, arranged alphabetically, are followed by a complete statement of the numbers published. Below this are given the numbers of the periodical to be found in one or more of the libraries represented. The size of the page is 8x10 in., and the printing is set up in two columns making it easy to follow. There are, in all, over 2600 main entries and cross-references with a list of indexes consulted, a list of the libraries and information regarding them, and a brief statement of the system followed. Above all, it is printed on heavy glare-proof paper, is strongly bound, and will prove a valuable addition to any engineer's library.

Naval Advisory Board

The Naval Advisory Board will consist of the following members, each of the 11 societies mentioned nominating two:

Thomas A. Edison, chairman.

W. R. Whitney and L. H. Baekeland, of the American Chemical Society.

Frank Julian Sprague and Benjamin G. Lamme, of the American Institute of Electrical Engineers.

Robert S. Woodward and Arthur G. Webster, of the American Mathematical Society.

Andrew M. Hunt and Alfred Craven, of the American Society of Civil Engineers.

Matthew B. Sellers and Hudson Maxim, of the American Aëronautical Society.

Peter Cooper Hewitt and Thomas Robins, of the Inventors' Guild.

Howard E. Coffin and Andrew L. Riker, of the American Society of Automobile Engineers.

William L. Saunders and Benjamin B. Thayer, of the American Institute of Mining Engineers.

Joseph W. Richards and Lawrence Addicks, of the American Electro-Chemical Society.

William Leroy Emmet and Spencer Miller, of the American Society of Mechanical Engineers.

Henry A. W. Wood and Elmer A. Sperry, of the American Society of Aëronautical Engineers.

Secretary Daniels announced, Sept. 12, the names of these 22 scientists and inventors who, with Thomas A. Edison as chairman, will assist the United States navy in its technical development.

The members of the board were chosen by 11 scientific societies of the United States, each of which nominated two men. Mr. Edison was chosen by Secretary Daniels for the chairmanship, the plan resulting in the creation of the board having been taken up first with Mr. Edison as the foremost inventor of this country.

Mr. Daniels announced that he has arranged for the first meeting of the advisory board to take place in his office at 11 a.m. on Wednesday, Oct. 6. At this meeting it is expected that organization will be effected and plans for the conduct of work discussed.

Zinc Production in China

According to an American consular report a Hongkong firm recently placed an order in the United States for a considerable quantity of zinc. Large quantities are used in Hongkong and in the trade field tributary to Hongkong. Heretofore these supplies have been secured almost entirely from Germany and Belgium, though at times some of the metal has been obtained in China. Zinc is produced in Kweichow and Hunan provinces in considerable amounts, and is exported in ordinary years to the extent of about a thousand tons of spelter and ten thousand tons of ore, mostly to Germany and Belgium.

[The production of spelter in China is statistically an unknown quantity. It is produced by a crude method of distillation in minute retorts and the output of any one smelter may be only a few tons per annum, but there may be a good many of them.—Editor.]

Asbestos Deposits Have Been Found Near Pachow in Chungking Province, China, according to a report from United States Consul E. C. Baker. As the asbestos appears to be of good quality and the price is low, the possibilities of direct exportation to the United States may be of interest to certain American dealers at this time. The mining expenses and cost of carriage to Chungking amount to about 75c. United States currency per 100 lb. The production and exportation of this article is a part of the industrial work for boys carried on under the direction of Rev. W. B. Williston, of the China Inland Mission at Pachow, Szechwan Province.

NEW PATENTS

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

AGGLOMERATION—Improvements Relating to the Agglomeration of Ores and Metallurgical Products. W. Buddeus, Charlottenberg, Germany. (Brit. No. 29,033 of 1913.)

ALLOYS or Compounds for Improving Copper and Its Alloys. Charles Vickers, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Co., New York, N. Y. (U. S. No. 1,151,744; Aug. 31, 1915.)

BLAST FURNACES—Method of Heating the Checker-Brick Heaters of Blast Furnaces. A. Pfoser, Baden, Germany. (Brit. No. 18,912 of 1913.)

BRIQUETTING—Mechanism for Preparing Pulverulent Materials for Molding or Briquetting. Ellsworth B. A. Zwoyer and Rolland A. Zwoyer, Perth Amboy, N. J., assignors to Zwoyer Fuel Co. (U. S. No. 1,152,469; Sept. 7, 1915.)

CHEMICALLY PURE METALS—Process for Producing Chemically Pure Metals. O. Voigtlander and H. Lohmann, Essen-Ruhr, Germany. (Brit. No. 27,369 of 1913.)

COPPER—Process for Separating Iron and Nickel from Copper in Certain Ores and Masses. Wilhelm Borchers and Eduard Thilges, Aachen, Germany. (U. S. No. 1,152,699); Sept. 7, 1915.)

CYANIDING—Apparatus for Treating Solid-Bearing Solutions. Lamartine C. Trent, Los Angeles, Calif. (U. S. No. 1,152,769; Sept. 7, 1915.)

DRILL HOLES—Device for Ascertaining the Vertical Angle and Direction of Diamond-Drill Holes. Helge A. Borresen, Marquette, Mich. (U. S. No. 1,152,701; Sept. 7, 1915.)

DRILLS—Chuck for Drills. Willis Coulson, Mace, Idaho. (U. S. No. 1,153,033; Sept. 7, 1915.)

DRILLS—Device for Rotating Pneumatic Drills. Henry J. Cook, Los Angeles, Calif., and Herbert E. Marsden, Ottumwa, Iowa. (U. S. No. 1,152,882; Sept. 7, 1915.)

DRILLS—Improvements to Rock Drills and the Like Cutting Machines. A. Berner, Nuremberg, Germany. (Brit. No. 35 of 1914.)

ELECTRIC FURNACE. Parvin Wright, Seattle, Wash. (U. S. No. 1,152,586; Sept. 7, 1915.)

ELECTRICAL FURNACE. William H. Hampton, New York, N. Y., assignor to Conley Electric Furnace Co., Inc., Wilmington, Del. (U. S. No. 1,152,505; Sept. 7, 1915.)

FLOTATION—Improvements in or Relating to the Concentration of Ores. Minerals Separation, Ltd., London, E. C., England. (Brit. No. 17,327 of 1914.)

HOISTING-ENGINE CONTROL. William J. Lilly, Butte, Mont. (U. S. No. 1,153,124; Sept. 7, 1915.)

LEACHING—Metallurgy of Copper. Raymond F. Bacon, Pittsburgh, Penn., assignor to Metals Research Co., New York, N. Y. (U. S. No. 1,151,236; Aug. 24, 1915.)

ORE REDUCTION—Improvements in or Relating to Ore-Reducing Furnaces. New Metals Process Co., Chicago, Ill. (Brit. Nos. 17,322 and 17,323 of 1914.)

PULSATOR for Pulsatory Tools. Arthur Henry Gibson, Easton, Penn., assignor to Ingersoll-Rand Co., New York, N. Y. (U. S. No. 1,151,936; Aug. 31, 1915.)

RADIO-ACTIVE MINERALS—Improved Process for Treating Ores of Radium, Mesothorium, Thorium and Other Radio-Active Substances. E. Ebler, Heidelberg University, Germany. (Brit. No. 28,445 of 1913.)

RECOVERY—Improved Process for the Recovering of Metal from Ore and Apparatus Therefor. New Metals Process Co., Chicago, Ill. (Brit. No. 17,325 of 1914.)

REVERBERATORY FURNACES—Improvements Relating to Reverberatory Furnaces. Manchester Furnaces, Ltd., and W. A. R. A. J. Lord Globe Works, Manchester, England. (Brit. No. 6,050 of 1915.)

SEPARATING—Ore-Separating Process. Arthur J. Moxham, Wilmington, Del. (U. S. No. 1,151,117; Aug. 24, 1915.)

SEPARATOR—Apparatus for Separating Coal, Ore, Etc. Frank Pardee, Hazleton, Penn. (U. S. No. 1,149,463; Aug. 10, 1915.)

SMELTING FURNACES—Improvements in or Relating to Smelting Furnaces. Anna Niewerth, Berlin, Germany. (Brit. No. 21,738 of 1913.)

STEEL—Process of Treating Steel. Charles Henry Augustus Frederick Lockhart Ross, Balmagown Castle, County of Ross, Scotland. (U. S. No. 1,151,049; Aug. 24, 1915.)

SULPHUR BURNER. Albert Gustav Hinzke, Rothschild, Wis., assignor to Valley Iron Works Co., Appleton, Wis. (U. S. No. 1,149,765; Aug. 10, 1915.)

SULPHURIC ACID—Method and Apparatus for Producing Sulphuric Acid. Georg Schliebs, Cologne, Germany. (U. S. No. 1,151,294; Aug. 24, 1915.)

SULPHURIC ACID—Process of Making Sulphuric Acid. Henry Howard, Brookline, Mass. (U. S. No. 1,151,103; Aug. 24, 1915.)

TUNGSTEN—Treatment of Refractory Metals. Gottlieb Gmür-Zehnder, Aarau, Switzerland. (U. S. No. 1,150,670; Aug. 17, 1915.)

ZINC—Electric Reduction of Zinc Ores. Woolsey McA. Johnson, Hartford, Conn., assignor to Continuous Zinc Furnace Co., Hartford, Conn. (U. S. No. 1,150,271; Aug. 17, 1915.)

ZINC—Method of Smelting Sulphide Ores. Henry L. Doherty, New York, N. Y. (U. S. No. 1,150,841; Aug. 17, 1915.)

ZINC — Process of Treating Zinc Tailings. Arthur C. Spencer, Washington, D. C. (U. S. No. 1,150,897; Aug. 24, 1915.)

Editorials

The Prospects for Copper

Up to about a fortnight ago there were two views respecting copper among producing and selling interests—one bullish, the other bearish. It is unnecessary now to discuss the reasons for the bullish view. The bearish was based chiefly upon the enormously increased production, the weight of which was considered bound to tell. Consumers also held this view and deferred further purchases, even requesting producers to anticipate contractural deliveries, with the expectation that later they would be able to buy copper much cheaper.

Recently there was a change of opinion among those selling interests that previously had been bearish. The reasons for this were two—a growing belief that the military use of copper is much greater than any previous estimate, no matter how large; and the perception that regardless of the increase in production, refining capacity imposes a limit that cannot be overstepped. It is significant that there is but little additional refining capacity in preparation, the only important construction of this kind being at Tacoma and Great Falls.

Confirmation of this theory is to be found in several important things that have recently transpired. Thus it is well known that recent refining contracts have been made at $20 per ton, whereas $15 was formerly regarded as a fine price. Moreover, although the British embargo on crude copper was lifted under certain conditions, the unusual disparity between the prices for electrolytic and standard has continued, showing that refiners are not in a position to buy standard freely. Finally, it is a matter of more or less common knowledge that several copper-producing companies are having to pile up blister copper in consequence of inability to have it refined.

At the beginning of 1915 the electrolytic-refining capacity of the United States was about 148 million pounds per month. At the middle of 1915 it was about 152 million pounds. The new construction that is now going on will raise it to 164 million pounds, but this will not be attained until the end of the year, and it may be that the new plant at Great Falls will not be ready until 1916. Included in the foregoing figures is the small capacity—about five million pounds per month—for electrolytic Lake copper.

The Donora Zinc Works

The Donora zinc smeltery of the United States Steel Corporation is going to be unique in zinc-smelting construction by reason of the extensive use of reinforced concrete in its several parts. There is to be approximately 50,000 cu.yd. of concrete, of which about 30,000 cu.yd. will be reinforced concrete. The plant is also remarkable for the speed with which it is being built. About 1,000 cu.yd. of concrete is being placed per day. This is being done by the Dravo Construction Co., of Pittsburgh. The American Bridge Co. is naturally doing the structural-steel work for the plant. The brickwork is being done by the Steel Corporation's own force of bricklayers, which is recruited from the several plants of the corporation, precedence over everything else being given to the Donora construction.

Contrary to previous reports, the Donora plant is the only one now being built by the Steel Corporation. After the first announcement it was intimated that it had been decided to divide the retorts between Donora and Gary, and the idea obtained credence in well-informed quarters that construction had actually been begun at Gary. This was erroneous, although it is not unlikely that a smeltery will be built at Gary, or in the Illinois coal field, later, which would be a natural development. The Donora plant will have about 10,000 retorts, which will give capacity for smelting about 100,000 tons of ore per annum and making about 40,000 tons of spelter, which will make it the largest zinc-smelting unit in the world.

Things in Technical Literature That Are Not So

In the great flood of literature that is flowing through the pages of the engineering and technical press there are bound to be blunders, the expression of erroneous opinions, the misstatement of what pass for facts. No editor is infallible either in his own writings or in the endorsement that he gives to contributors by printing their articles. However, the contributors are the main offenders, for the simple reason that there are more of them.

Now, there is no great harm in the expression of an unsound opinion. Everybody knows that it is merely an opinion that may be right, may be wrong. Each expression will be weighed by itself. The reprehensible thing is for some one to represent as a fact what is not a fact. That this may happen out of carelessness—intentional deception is probably rare—is no palliative of the harm that is done. The following excerpts from a communication of a correspondent in South America is illustrative of what we mean:

> It has been a pleasure to me to supply the inclosed information, the more because in the course of years American technical papers have been publishing a lot of nonsense about this country. There is a certain Mr. —— who wrote in the "Journal" and also in the —— about Bolivia, and from his writings I conclude that he was in Bolivia about 10 years ago, and then only for a couple of days. His articles are simply redundant; everyone who knows anything about Bolivia is aware of the fact that the mining laws, and especially their execution, are so bad as to prevent any foreign capital from coming in, and that the Bolivians are the worst people on earth from whom to buy mines. There were also some small errors in the editorial in the "Journal" of Oct. 10. The Cia. Minera de Oruro uses the Ingersoll stoper BC-21 in addition to jackhamers for mining. Further, there are no steam pumps; the water is so acid that lead-lined pipe would be required, so the mines are kept dry by bailing with automatic tanks. The San José mine, which lies between two mines of the Cia. Minera de Oruro and works the same veins, bails with buckets made of rawhide. No steam is used at present in either San José or the Oruro mines; the first company has a 200-hp. Diesel engine, and the Cia. Minera de Oruro uses a power plant of 300-hp. Diesel engines and a 120-hp. suction gas motor, which generate a 1000-volt three-phase current.

This power is only used for the mines, the mill at Machacamarca having its own gas-producer power plant.

The —— published some time ago the cost of getting one ton of concentrate from Bolivia to the European smelters, but this account was silly and confusing. It is remarkable that the information published about Bolivian conditions should be on the whole so unreliable. It seems to me that most of the articles are written by people who visit the country for a few days, absorbing during their short stay all the talk that Bolivians will let them have, thinking that they would publish that afterward as true, first-hand information, and that there were no men in the country who did not know better. For instance, I remember some time ago a certain Mr. —— wrote in the —— that the mines of Oruro did not produce any tin, but principally copper, whereas they were shipping tin concentrate at that time at the rate of over 200 tons per month, against two tons of copper precipitate of about 25% Cu. I have often thought to call those scribes to account, but after all did not think it worth while.

We hold that it was not only worth while but that it ought to have been done. The printing of erroneous statements in a technical magazine is apt to be perpetuated by the professors in their textbooks and treatises. Thus there creeps into permanent literature the recording of many things that are not so.

The correspondent whom we have quoted puts his finger upon the explanation of much of this. The editor accepts a contribution from a person whom he knows and believes to be reliable. It may turn out, however, that the contributor was deceived. There does not appear to be any effective way of preventing this. The only thing that can be done in most cases is to print a correction, and in the interest of everybody the readers of a paper ought to draw attention to misstatements that they observe in its pages.

Zinc Refining by Redistillation

The extraordinary premiums that have been paid for high-grade and superior intermediate spelter led naturally to the production of such spelter by refining by redistillation, and a large tonnage of refined spelter is now being produced in that way. As has been previously pointed out in the *Journal,* there is no novelty in this, a good deal of refined spelter having been so produced during many years by dross and junk smelters in this country and Great Britain, and also in Sweden and Norway, and perhaps elsewhere. The dross and junk smelters in this country commonly perform the redistillation in large retorts. The smelters in the Scandinavian countries do it in electric furnaces. The practice recently developed in the United States is novel in that the ordinary ore furnace is used for the purpose. Yet even that is novel only in the making of a regular practice of it.

The same thing was tried about 17 years ago in one of the works of the old Cherokee-Lanyon Spelter Co., then managed by A. B. Cockerill. Mr. Cockerill, who was something of an experimenter, thought then to improve his metal product by redistillation. He found that he could make a refined spelter assaying approximately 99.9% Zn, but he found also that he lost about 10% of his zinc in doing it (by absorption in retorts, breakage of retorts, failure to condense, etc.), and the premium realized for high-grade spelter at that time was not enough to pay for making it in this way. When, however, the premium rose to 10@15c. per lb., as it did recently, the aspect of things was changed radically.

Nevertheless there is some doubt as to just how much profit there is in refining spelter by this method under existing conditions, exceptional as they are. The slabs of common spelter are broken up or are recast in little bars, and are piled up in the ordinary retorts, which are heated in the ordinary way. The direct cost of redistillation is variously estimated at 0.5 to 1c. per lb., probably being nearer the lower figure than the higher. Then comes the cost of the zinc that is lost. This is variously stated at 10 to 12%—a confirmation of Mr. Cockerill's experience. If the common spelter that is being redistilled costs 10c. per lb., the loss is 1c. per lb. If it costs 20c. per lb., it is twice as much. The third element of cost is the use of smelting capacity. In normal times, when there is a surplus, this might reasonably be reckoned as nil, but certainly not so at present when smelting capacity is so urgently needed. An Iola furnace of 600 retorts is figured as taking about 30 tons of spelter per day for redistillation, or 60,000 lb. Such a furnace takes normally about 12½ tons of calamine or roasted blende. If the latter, say about 15 tons of raw blende. Now if the smelter can make a profit of $40 per ton in smelting ore (he talks about such figures), he does not make it if he uses his furnace for refining spelter, and such use may therefore be reckoned temporarily as costing him $600 per furnace per day, or 1c. per lb. The total cost of refining is therefore from 3 to 4c. per lb., which is not bad if a premium of 10c. be realized. We understand, however, that there has been some difficulty in bringing all of the product up to the highest grade.

There would probably be a better way of refining crude spelter by redisillation than by using the ordinary ore furnace for this purpose. A specially adapted, fire-heated retort, or an electric furnace after the fashion of Trollhättan, would probably be superior. However, our metallurgists were confronted by an emergency and had no time for either experimentation or new construction.

The craze for high-grade spelter on the part of the Allies prompts the inquiry, What have the Germans been doing for it? In the first place they had a large accumulation of New Jersey willemite which they had been importing and storing during many years. Secondly, they also have been refining crude spelter by redistillation. Having a surplus of smelting capacity and an ample supply of spelter this is for them a relatively inexpensive process.

New Projects at Joplin

Two interesting schemes are being promoted in the Joplin district. One of these is for the erection of warehouses, into which ore may be put for storage when the market is unsatisfactory. The other is the erection of a zinc-smelting works to be owned and operated by local persons. Both of these ideas are excellent, and it is to be hoped that they will be carried out. The Joplin district has always been prosperous, and lately the increase of its wealth has been phenomenal, wherefore there ought to be no difficulty in obtaining the necessary money right at home. The advice may be offered, however, that care be taken not to let the promotion and organization expenses run too high, and also that good engineering advice be secured for determining the location and making the plans for the smelting works. Some persons experience a conniption fit when they are told that engineering expense may come to 10% of the total cost of construction, but it is better to pay the engineers $50,000 out of a total of $500,000 than to pay them only $5,000 out of a total of $600,000 and get a poor plant at that.

BY THE WAY

The plan of reincorporation of the du Pont Powder Co. with $120,000,000 capital has been noted in the *Journal,* but on Sept. 4 application was filed for a charter for E. I. du Pont de Nemours & Co. with a capital of $240,000,000, of which $150,000,000 is to be nonvoting preferred, $10,000,000 voting debenture shares, and $80,000,000 common.

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Men who are engaged in large affairs often have hard work to determine where good things ought to be placed among their many personal and corporate interests. Too many of our big companies have managements that look upon their companies as customers for their indifferent or doubtful ventures, while the good ones are their own. The attitude is similar to that which is ascribed to Chinese government officials, who are said to look out carefully for the interests of their government when they do not conflict with their own.

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The main business street of Kusa, Okla., will be paved with material which contains both gold and silver. It is the residuum or "sludge" from a zinc smelter there, according to the New York *Tribune.* An official of the townsite company has completed arrangements with the smelters to save the waste material. The paving will be done in 60 days. Much of the ore, 100 tons of which will be smelted daily, carries considerable gold and silver. When the gold value is sufficiently great to defray the cost of shipment it is sold to smelters. If found to be insufficient it will be used on Kusa streets.

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The term "sappers and miners" is often used for one reason or another, but beyond knowing that it is a military term, seldom with any comprehension of the meaning of or the distinction between the two. The mines and countermines which are used against the enemy are prepared by the miners, while the open trenches, of which so much is heard in the war news of today, are prepared by the "sappers." In military parlance a sap is a narrow trench in the direction of the enemy, generally at an angle to the line of advance to protect against enfilade fire, to give protection of approach or to afford an opportunity for mining the enemy's position.

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According to word received in Ottawa, Kan., from Dr. J. Scott Walker, of Chetopa, Western points have no more reason to become excited about gold than has Chetopa. A Denver commission man came all the way to Chetopa to investigate, say press dispatches. For three years past the Chetopa poultry dealer has been shipping large consignments of ducks to the Denver man, who regularly found a quantity of gold in the gizzards of the birds. Particles the size of a pinhead were found and the total amount usually netted a tidy sum for the commission merchant, in addition to his profits for handling the ducks. He went out to the district whence the ducks came and looked around, after which he slipped quietly back to Denver. But the price of land near Chetopa increased materially as a result of his visit when the news leaked out.

A recent number of the "Safety Bulletin" of the Illinois Steel Co. gives the following directions on how to make money at home: Start a saloon in your own house. Be the only customer (you'll have no license to pay). Go to your wife and give her $2 to buy a gallon of whiskey, and remember there are 69 drinks in a gallon. Buy your drinks from no one but your wife, and by the time the first gallon is gone she will have $8 to put into the bank and $2 to start business again. Should you live 10 years and continue to buy booze from her, and then die with snakes in your boots, she will have enough money to bury you decently, educate your children, buy a house and lot, marry a decent man, and quit thinking about you entirely.

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Practical experience tells just as surely in war as in peace, says the London *Financial Times.* Mining men are chuckling over how one of their number recently caught out some Royal Engineers who were engaged in warlike mining operations. While in the saps the latter found their light compasses played them some queer tricks, and accordingly they indented, ingenuously enough, for good solid ones of 12 lb. weight. Along came a mining man to the excavations a day or two later and, the vagaries of the original compasses being demonstrated to him, he drily remarked: "What about those picks and shovels in the corner there?" Naturally, as soon as the iron was removed the compasses became normal again, and the "twelve-pounders," which duly arrived later on, were not even unpacked. By the way, while compasses are, of course, very handy and at the same time sufficiently accurate for temporary operations such as mentioned, they are becoming almost obsolete in mining proper.

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Virginia City was always speculatively inclined, says Charles E. Van Loan in the *Saturday Evening Post,* but the high tide struck the Comstock in the '70s. Men went money mad, and women, too. In 1870 stock in the Belcher mine went begging at $1 a share; in 1872 it was worth $1525. During the same period Crown Point advanced from $2 to $1825. Those were the days when stock quotations were posted every hour. When the miners came up out of the shafts they rushed to the bulletin boards to see how much money they had made while underground. Rich and poor, high and low, white, black and yellow, everybody gambled. The financial giants of San Francisco were juggling Virginia stocks, and nobody had to wait long for action. Fortunes were made and lost every day. A chambermaid in Virginia City "fooled with stocks a little," and in 1875 she retired with a bank balance of two hundred thousand dollars. A man in Gold Hill lost the best cook he ever had just because she got rich when Consolidated Virginia went up. A $25 investment in Consolidated Virginia would have paid $109,980, if—and this is a big if—bought at the bottom and sold at the top. The same investment in Belcher would have paid $38,125 and in Crown Point, $22,800. At one time or another fortune's wing grazed every man on the Comstock; the grizzled veterans of the bonanza period are able to point out the exact spot where they missed their big chance. "You see," says the Oldest Inhabitant, "there was the stock you knew you ought to buy, but didn't. There was the stock you bought and sold too soon. And then there was the stock you didn't sell soon enough."

Lake Superior Mining Institute

The Sept. 11 issue of the *Journal* contained the telegraphic account of the twentieth annual meeting of the Lake Superior Mining Institute, which opened at Ironwood, Mich., on Sept. 6. Some features of this year's meeting deserve further mention.

Unknown First-Aid Problems

The first-aid contest, held on the morning of the first day, was particularly interesting because the problems used were unknown to the contestants until read to them on the field. Heretofore the problems have been of a more technical nature, permitting previous training with a certain degree of accuracy. Following are the four problems given at Ironwood:

One-Man Event (Time: 15 Min.)—Miner found a distance of 20 ft. in, in closely caved workings, with palm of right hand lacerated and bleeding profusely; in shock. Treat and transport 20 ft. to more open workings, then carry 20 ft. by shoulder lift.

Three-Man Event (Time: 15 Min.)—Miner found in caved drift (2½ to 3 ft. high) in bad air after explosion of powder, unconscious from gases, burns of face and hands. Transport for 20 ft. and administer artificial respiration by Schaefer method for one minute. Treat burns. During transportation one of the rescuers is overcome, becoming unconscious; rescue and administer proper treatment.

Team Event (Time: 20 Min.)—Miner caught by fall of rock; left ear torn off, left shoulder dislocated, left thigh broken in upper third of leg (compound fracture), with profuse bleeding; in shock. Treat and transport 30 ft. on improvised stretcher.

Team Event (Time: 20 Min.)—Miner walks into blast; face badly lacerated over left cheek bone with profuse bleeding; severe laceration of upper part of abdomen; back of right hand lacerated, blood oozing; fracture of right kneecap; unconscious from powder gases; treat on spot (gas has cleared away) and transport 40 ft.

Teams in Good Condition

As pointed out by Dr. A. F. Knoefel, in charge of the judging, and president of the American Mine Safety Association, the slight range of points scored by the winning teams indicated the excellent condition of all teams. He stated that the latter are as good as or better than those he has encountered anywhere else. Each team was told why it was penalized and every member of every team after the contest received a copy of the tally sheet.

Mining Practice on Gogebic Range

In the paper on "Mining Methods on the Gogebic Range," presented at the Monday evening session, O. E. Olsen pointed out some interesting innovations. It has been found desirable to use automatic gongs on the underground locomotives, as well as red lights on the tail of the trains. The gongs are connected with the driving mechanism, and start ringing when the motor starts and vice versa; they can be heard for about 250 ft. The paper on the "Opening of the Wakefield Mine," by W. C. Hart, superintendent of the Wakefield Mine, aroused probably the greatest interest. Doubtless this was because of the fact that Mesabi stripping methods are seldom used on the Michigan ranges. Also the pit had been visited in the afternoon and many had questions to ask.

The depth to which it is profitable to strip came in for its share of discussion.

Cuyuna Range Visited

It is safe to say that the Cuyuna Range never before received so much concentrated attention from mining men as it did on the following day, Tuesday, Sept. 7. George H. Crosby, a pioneer on the Cuyuna since its earliest days, was on hand to see that no point of interest was overlooked—and none was. Carl Zappfe, geologist of Brainerd, Minn., who for years has made a particular study of the formations on the Cuyuna, was able and willing to give the visitors a good understanding of the peculiarities of the range, difficulties of exploration and mining and future possibilities. This was welcomed and appreciated, and there is no question that operators present from the other Lake Superior ranges now have a better knowledge and probably a more favorable impression of the Cuyuna Range.

Standing Committees Appointed

The final business session was held at Crosby, Minn., where the following officers were elected: President, C. E. Lawrence, Palatka, Mich.; vice-presidents, George L. Woodworth, Frank E. Keese, Frank S. Barber; managers, Frank Armstrong, William Wearne; treasurer, E. W. Hopkins; secretary, A. J. Yungbluth.

Standing committees for the year 1916 were also appointed: Prevention of Accidents, W. H. Jobe, Palatka, Mich., chairman; William Connibear, Ishpeming, Mich.; E. W. Walker, Mass, Mich.; W. H. Harvey, Virginia, Minn.; P. S. Williams, Ramsay, Mich. Care and Handling of Hoisting Ropes: W. J. Richards, Painesdale, Mich., chairman; C. E. Holley, Ishpeming, Mich.; C. W. Murphy, Crystal Falls, Mich.; F. H. Armstrong, Ironwood, Mich.; A. Tancig, Hibbing, Minn. Papers and Publications: William Kelly, Vulcan, Mich., chairman; A. W. Gow, Duluth, Minn.; F. W. McNair, Houghton, Mich.; J. E. Jopling, Ishpeming, Mich.; Frank Blackwell, Ironwood, Mich. Bureau of Mines: M. M. Duncan, Ishpeming, Mich., chairman; F. W. Denton, Painesdale, Mich.; A. J. Yungbluth, Ishpeming, Mich., secretary. Biography: J. H. Hearding, Duluth, Minn., chairman; R. A. Douglas, Ironwood, Mich.; M. B. McGee, Crystal Falls, Mich.; W. H. Newett, Ishpeming, Mich.; James Fisher, Houghton, Mich.

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The Redjang Lebong in Sumatra, the best-known gold mine in the Dutch East Indies, had an unsatisfactory year in 1914, owing to the drought, which extended from May until the middle of November. As the mine depends on water for power purposes, a gradual stoppage of operations was necessitated. Milling was practically suspended for three months, and in October it was feared that the lower levels would be flooded out, as the pumps could only be kept going to a modified extent. As a result the ore crushed showed a heavy decline, amounting only to 62,037 tons, which yielded 28,047 oz. gold and 154,870 oz. silver—an average of 0.452 oz. gold and 2.496 oz. of silver per ton. In 1910, the most prosperous year, there were 109,715 tons of ore crushed, with a return of 85,250 oz. gold and 441,914 oz. silver, an average of 0.778 oz. gold and 4.035 oz. silver per ton. The ore reserves at the end of the year are estimated at 211,000 tons, averaging 0.44 oz. gold and 2.65 oz. silver.

PERSONALS

Arthur W. Burgren is now with the Cinco Minas Co. at Magdalena, Jalisco, Mexico.

D. C. Jackling recently visited the Ray mines and concentrating plant at Hayden, Arizona.

George Long has returned to the United Eastern mine at Oatman, Ariz., after a vacation on the Coast.

C. W. Wright is returning to Sardinia, Italy, having sailed from New York, Sept. 11, on the "Dante Alighieri."

E. A. Cappelen Smith, having put the Chuquicamata plant into successful operation, has returned to New York.

J. B. Armitage of Duluth, Minn., is making examination of a gold-mining property in Rio Grande County, Colorado.

J. R. Finlay has gone to Butte, Mont., where he expects to be occupied with professional work for about two months.

Carl M. Bernegau, vice-president and treasurer of the Keuffel & Esser Co., New York, has been traveling in the West.

H. A. Wagner of the Gray Eagle Reduction Works at Mayer, Ariz., will attend the International Engineering Congress.

A. L. Flagg, superintendent of the Kelvin Sultana mine, is attending the International Engineering Congress in San Francisco.

J. V. N. Dorr, of the Dorr Cyanide Machinery Co., has arrived at New York from San Francisco. He will remain about two weeks.

Alden D. Perley has been appointed superintendent of Hall Furnace of the Republic Iron & Steel Co., Sharon, Penn., which has just gone into blast.

George H. Garrey, who has been on work in the West for the past two months, spent a couple of days in New York last week, but has again left for California.

Frank Jewett, vice-president of the San Francisco Stock Exchange and A. S. Wollberg, member of the governing board, recently visited the Oatman-Gold Road mining districts in Arizona.

W. de L. Benedict left New York last week on his way to California by way of Denver, on professional business. Incidentally he expects to attend the engineering congresses at San Francisco.

James Myers, of Golden, Colo., has again assumed the superintendency of the old Brown Mountain smeltery at Ouray, Colo. It has been operated by the Wanakah Mining Co. for the past two years.

E. L. Rodgers and party of New York have been traveling by automobile in Montana and Washington, and recently left Spokane for Hedley, B. C. Mr. Rodgers is interested in mines in the Basin District in Montana.

F. C. Newton has resigned as superintendent of the Perth Amboy plant of the American Smelting & Refining Co., to become vice-president and general manager of the Newton Manufacturing Co., of Lowell, Massachusetts.

William J. Chamberlain of Denver, well-known mining man and president of the long-established sampling works company bearing his name, was married in Denver, Sept. 3, to Miss Eugenia A. Brueck of Kansas City.

H. W. McCaskey of the United States Geological Survey is in Salt Lake City on a trip of inspection of the Western offices. Mr. McCaskey expects to visit the Alta-Cottonwood district, and the new camp of Goldstrike in Washington County.

George B. Drummond, of Eau Claire, Wis., left on Sept. 7 for the interior of Honduras, Central America, having accepted the position of cashier of the Ulcawas Gold Mining Co. His duties will include the purchase of supplies and machinery.

F. C. French, who has been with the Butte & Superior Copper Co. and other copper properties in the Butte District for the last three years, has returned to Salt Lake City, where he will soon reopen offices for the practice of civil and mining engineering.

G. C. Riddell, superintendent of the East Helena smelting plant, has been a recent visitor in New York and St. Louis. He is on a general tour of zinc- and lead-smelting plants in the East and South, while returning from a vacation on the Atlantic Coast.

W. L. Honnold, who has recently retired from the chairmanship of the Brakpan Mines, the Spring Mines, and the Transvaal Coal Trust, has taken up his residence at the Hyde Park Hotel, London. Mr. Honnold will join H. C. Hoover in the Belgian relief work, and will go to Belgium in October.

Dr. T. O. Bosworth, petroleum expert, who has been making extensive explorations in Northern Alberta, is now pursuing his investigations in the Peace River country. He will lecture in London, England, before the Institute of Petroleum Technologists and hopes to interest British capitalists in the resources of the Canadian West.

It is stated in "Nature" that the sum of £140 has been given to the Royal Society of Arts by R. Le Neve Foster for the purpose of founding a prize in commemoration of his father, Peter Le Neve Foster, who was secretary of the society from 1853 to 1879. The council has decided to offer the prize (consisting of £10 and the society's silver medal) for a paper on "Zinc: Its Production and Industrial Applications."

Vice-President C. F. Kelley of the Anaconda Copper Mining Co. will transfer his residence from Butte to New York on Oct. 1, in order to be more intimately related, in an official way, to the affairs of the Anaconda company, under conditions that result from its recent reorganization. As a result of the acquisition of the International Smelting Co., the Raritan Copper Works and the United Metals Selling Co., the company's business has greatly enlarged, and it has been deemed necessary to increase the executive organization of the company in New York. Mr. Kelley will continue to have direct connection with all operations of the company in Butte and Montana.

OBITUARY

Alexander Tropenas died at Lyons, France, July 14, aged 55 years. He was widely known as a metallurgist and as the inventor of the Tropenas converter.

Charles M. Cabot, who as a stockholder of the Steel Corporation, gained some prominence several years ago by attacking labor conditions in the iron and steel industry, died at his home at Beverly Farms, Mass., Sept. 5. He was 49 years of age. Mr. Cabot served as a member of a committee of stockholders which investigated the general conditions among employees of the Steel Corporation and made certain recommendations subsequently put into effect. In business life he was engaged as a broker. Mr. Cabot was called a crank when he first brought up the subject at the Steel Corporation meetings, but his activity and persistence had much to do with the later action for safety of employees and improvement of working conditions.

SOCIETIES

American Institute of Mining Engineers—In order to make the meetings of the Southern California Section more interesting and fruitful, the executive committee has formed a subcommittee on programs for section meetings, which announces for the coming autumn and winter season, four dinner meetings, at intervals of two months, in which the coöperation of all section members is urgently requested. The subjects chosen for discussion at these meetings, with the proposed dates, are as follows: Sept. 28, "Mining Geology of Mojave County, Arizona"; Dec. 14, "General Geology and Mining Conditions in Southern California"; Feb. 1, 1916, "Petroleum, Its Geology and Technology"; Apr. 4, "General Mining Conditions in South America." Notice of the hour and place of each meeting will be issued later.

University of Arizona—The number of inquiries that have been received relative to the short course for miners to be given by the College of Mines and Engineering of the University of Arizona has proved that there is a great demand for such work. The particular value of the short course as it is to be given by the university lies in the method by which it is to be conducted, which is the intensive study of one subject for two weeks. Inasmuch as the short courses that are of particular interest to the prospectors start early in October, it is desired that those interested make their plans early for attendance. Students may take two, four, six or any number of weeks, the whole year making an admirable trade course in mining. The first course starts Oct. 4, being elementary mineralogy and blow-pipe analysis. Besides this course those of interest to prospectors which immediately follow are courses in elementary mineralogy and petrology, principles of surveying, field geology and prospecting, and assaying. These courses together last 10 weeks, and will be an excellent foundation for more scientific and successful prospecting.

Editorial Correspondence

SAN FRANCISCO—Sept. 8

Gold Was Produced in 30 Counties in California in 1914. Seven of these counties, according to Charles G. Yale, of the U. S. Geological Survey, yielded over $1,000,000 each: Nevada, $3,301,948; Amador, $3,082,002; Yuba, $2,800,713; Sacramento, $2,164,491; Butte, $1,697,120; Calaveras, $1,336,875; Shasta, $1,101,202. This includes both lode and placer production. The leading hydraulic county was Trinity. Placer was the leading drift-mining county and Yuba the leading dredging county. Of the deep-mine producers Nevada County was in the lead, and this county also made a larger increase in gold production in 1914 as compared to 1913, the amount being $383,215. The total ore milled in the state from deep mines in 1914 was 1,993,821 tons. Of this amount 62% or 1,243,529 tons came from the five counties of Amador, Calaveras, Eldorado, Mariposa and Tuolumne. The average yield of ore in Mariposa County was $9.19 per ton; Eldorado, $4.95; Amador, $4.89; Tuolumne, $4.24; Calaveras, $2.32. The two largest lode-mining camps are Grass Valley-Nevada City and Jackson-Sutter Creek. In the Jackson-Sutter Creek district 387,602 tons of ore were treated yielding in gold and silver an average of $5.48 per ton. In the Grass Valley-Nevada City district 267,618 tons yielded in gold and silver an average of $11.38. Kennett, Shasta County, was the most productive metal camp in the state in 1914, producing 243,138 tons yielding $376,846 in gold, $299,110 in silver, $2,411,323 in copper; a total of $3,087,279 or an average of $12.70 per ton. The report shows that silver was produced in all the gold-producing counties; but the leading gold producers were by no means the leading silver producers. The nine counties producing as much as 10,000 oz. were: Shasta, 626,954 oz.; Inyo, 466,575; Calaveras, 109,299; San Bernadino, 67,737; Nevada, 48,487; Amador, 30,800; Tuolumne, 21,731; Mono, 16,436; Kern, 14,470 oz. The total amount produced in 30 counties in 1914 was 1,471,859 oz., being an increase of 92,960 oz. over 1913.

Hookworm Disease Endemic in California Mines in certain mining districts is the finding of Herbert Gunn, M. D., of San Francisco. He further finds that from 50 to 80% of the men working in the mines inspected are infected with the disease; and that the infection is undoubtedly present in practically all of the gold mines in California and just over the border in Nevada. A number of men were examined in Amador and Eldorado Counties and whether the disease is of foreign origin or endemic in the mines, the fact remains that hookworm disease actually exists according to Doctor Gunn's report and the reports of Dr. F. F. Sprague and Dr. E. E. Endicott. The earlier cases reported were Italians, Austrians or Cornishmen, many of whom are known to be infected with hookworm before coming to this country. Of six cases referred to by Doctor Gunn two were American, native of California and never out of the state, two were native of England, one native of Italy and one whose nativity is unknown but who had not been out of California in 48 years. Doctor Gunn states that there is no question that the general efficiency is noticeably impaired and that many of them have to take time off now and again to recuperate. The greatest loss to the mine operators he states is occasioned by the large number of men moderately affected. The danger of the disease being spread is commented upon especially as the sanitary arrangements for the disposal of sewage in the town of Jackson are poor and many of the infected miners too ill to work in the mines live on the nearby farms until recuperated. In connection with Doctor Gunn's report which is made to the California State Board of Health it is stated that the Industrial Accident Commission will take up the matter under recent amendments to the Workman's Compensation law, which make occupational diseases subject to compensation from employers. It is suggested that it will be a part of the duty of employers to endeavor to prevent the disease from spreading. In most cases it is quite likely that the municipalities in which the miners live are more amenable to law than the mine operators, but this particular law applies only to employers. But Jackson is not the only mining town in California that is in need of sanitary regulation; and it is quite likely that wherever hookworm disease is found there will also be found unsanitary living quarters either in the town or at the mine. The prevention of the disease cannot be accomplished except by control of the municipalities in which the infected men reside.

DENVER—Sept. 9

Official Measurement of Drainage Water issuing from the Roosevelt tunnel in the Cripple Creek district was made Sept. 1 by Engineer T. R. Countryman. Drainage amounts to 11,200 gal. per min. The breast was advanced 230 ft. during the first month after resumption of operations and is within 1,400 ft. of the Elkton mine. Three shifts are employed and Supt. Charles Fuller expects to reach the Elkton shaft about Jan. 1.

Boulder County Metal-Mining Association has published, for free distribution, a neat 52-page pamphlet descriptive of the history of mining for precious, semiprecious and rare metals, coal, oil and gas, and nonmetallic minerals in this pioneer county of Colorado. Each of the eight metal-mining districts in the county is described geologically and mineralogically, while one chapter is devoted to the tungsten industry. The pamphlet will be welcomed by persons who appreciate straightforward descriptions of the mining country without exaggerations. It may be had upon application to the secretary of the association, Boulder, Colo.

A Tonnage Record for the Cripple Creek District was established in August when 84,800 tons of ore were shipped to mills and smelteries. This does not mean a maximum valuation for a single month's output, the August production being valued at $1,242,264, or approximately $14.65 per ton. The Pueblo and Globe plants of the American Smelting & Refining Co. handled about 4,000 tons having an average value of $55 per ton; the Golden Cycle cyanide plant at Colorado City treated 38,000 tons of an average value of $19; the Colorado Springs mill of the Portland company handled 10,500 tons worth about $21 per ton; the Portland company's two mills in the district treated 30,600 tons of dump and low-grade material worth $2.59 per ton.

The Federal Industrial Relations Commission Report is so flagrantly unfair to the mining operators of Colorado that Governor Carlson has issued a statement specifically challenging the charge made in the Walsh report that an instructor in the state-university college of law had been dropped through corporation influence because he had appeared as counsel for the United Mine Workers during the strike turmoil a year ago. Explaining that this James Brewster was appointed only to fill a vacancy caused by the drowning of Professor Pease, the appointment being for the remainder of the college year only, Governor Carlson goes on to say: "Walsh and his puppets have not spared from calumny and false imputation the good name of our university. His insatiable gluttony for cheap publicity has caused him to utter a baseless and wicked charge. Had he made an honest investigation he would have found that the charge had foundation only in the mind of a disgruntled professor. . . . Walsh's statement may be given temporary credence in other states but not in Colorado."

The Florence & Cripple Creek R.R. Co. has Passed. It built the first rail line—a narrow gage—into the district, in 1894, and for a few years did a capacity business at high rates. The Midland Terminal Ry. soon followed, with a branch from the main line at Divide, a station on Ute Pass. Some years later, the Colorado Springs & Cripple Creek District R.R. built into the district, circling Pike's Peak on the east and south. The Florence road paid for itself within three years. Competition and numerous serious washouts of track then decreased this road's profits until it finally consolidated with the other roads all of which it then operated with financial success for years. The company also purchased the Golden Circle R.R., a 5.72-mi. electric line that traverses the high, central part of the mining district and reaches numerous large mines not served by the steam roads. The original outside terminal of the pioneer road was Florence but it was shifted to the neighboring town of Cañon City. The recent decision of the directors to abandon the old line follows acts of the residents of the latter town who insist that the company rebuild practically 10% of its roadbed destroyed by floods. This the company did not feel justified in doing since the cessation of cyanidation and chlorination activities in the several custom-treatment plants that formerly existed at Florence. The company has reorganized as the Colorado Springs & Cripple Creek R.R. Co. and will operate all lines except the old narrow-gage. It has started

suits against the treasurer and board of commissioners of Teller County, seeking to prevent the sale of the roads for delinquent taxes and to have tax assessments reduced. The assessed valuation of the Terminal at $25,686 per mile and that of the Golden Circle at $21,872 per mile are claimed, by the company, to be grossly excessive, and payment has been offered the treasurer of the county on what are claimed reasonable figures.

BUTTE, MONT.—Sept. 9

Anaconda Zinc Experiments have been so successful that it is said a plant capable of producing 10 tons per day is now going to be installed. The Anaconda management is active in keeping its engineers in the field, looking for new gold, copper and zinc mines. The recently acquired mines in Chile are reported to be developing favorably.

In the First-Aid Contest Between Butte Teams at the Labor Day celebration at Columbia Gardens, Butte, the team of the Original mine won the honor of going to the national meet at Panama Exposition the latter part of September and will represent the State of Montana in that event. The Original team consists of the following: Elmer Kelly, captain; David Snell, Joseph Beadle, John Campbell, John Butler and Thomas McKeown.

Reduced Wage Scale for Butte Miners—Miners' wage scale for August in Butte district will be at the rate of $3.75 per day instead of $4 per day, as paid in July. Official price of copper, as announced in the "Engineering and Mining Journal," was 16.9c. per lb. for August, or a tenth of a cent below the required 17c. to make the scale $4 per day. Payrolls of all Butte companies, including zinc producers, are based on the copper scale and all companies are making out their rolls on basis of 16.9c. per lb. Opinion prevails that September scale will be back at the $4 rate.

No Miners Marched in the Labor Day parade at Butte. The celebration of Labor Day was the biggest event of the kind ever seen in Butte. All but about half a dozen unions in Butte participated in a parade and the day's celebration. The parade was several miles long, requiring 1 hr. and 35 min. in passing, but not one miner was in the line of march. The large turnout of other union laborers was due to extra efforts that were made by the officers to get the men out in order to make an impressive showing, and heavy fines were provided for failures to march. There is no miners' union in Butte that is strong enough to enforce any such orders on the miners, although there are now three organizations calling themselves miners' unions.

The Butte-Duluth Bankruptcy Proceedings have finally been heard in the Federal Court at Butte and Judge Bourquin has under consideration the petition to declare the company a bankrupt. The petitioners, a number of unpaid miners, based their contention of insolvency on the admissions made in behalf of the company when the latter was thrown into the hands of a receiver upon suit brought by an Eastern creditor. The officers now claim, and did so in the bankruptcy proceeding, that the company is not insolvent, and that it was beginning to make money under the management of Receiver Everett when operations were stopped by the bankruptcy action. Some interesting testimony was given by officers of the company. Superintendent Sherwood stated that the mill was running on ore averaging 1.52% Cu during the last four months of operations, and drill cores to a depth of 202 ft. from the bottom of a 23-ft. pit ran from 0.98 to 2.70% copper. He said that the leaching plant of the Butte-Duluth was the first of its kind ever installed, but since it has been perfected three other similar plants have been installed in other places and are operating successfully on sulphide ores. At the time of the shut-down the Butte-Duluth had just reached a stage where it could operate its mine at a profit. A saving of 50% is now possible in buying acid for the plant, as it used to cost $25 per ton to bring it from Denver, and now it may be secured from the Anaconda company at $12.50 per ton. This effected a saving of 38c. per ton of ore treated. Receiver Everett estimated the value of the company's property at $741,368, against an indebtedness, bonded and otherwise, of $241,368. The total of claims filed is $190,833, of which $42,368 is represented by due bills to miners.

Anaconda Has About Reached Normal Capacity of its mines and it is not expected that the monthly figures will hereafter show any remarkable gains until after the first of the year when the Great Fall smelting works will be in full commission again. The August production, 22,800,000 lb., was the largest of any month this year. The figures for the eight months of 1915 follow: January, 13,700,000 lb.; February, 15,100,000; March, 19,000,000; April, 21,800,000; May, 20,500,000; June, 22,100,000; July, 22,100,000; August, 22,800,000; total, 157,100,000; the figures include the output of the Anaconda company and also the copper from ores received from the North Butte and other smaller producing concerns. The Anaconda company is pushing development work at various properties—copper, silver and zinc properties—but it will be a long time before these mines will be producing. While the pumps are running night and day in the Nettie mine, the silver property on the west side of the Butte district, it is expected that the mine will not be completely unwatered for four or five months. The Nettie seems to drain the entire western section of the district, and before the shut down and curtailment last fall the pumps had been running for eight months, and still all the water was not out of the mine. The Nettie vein is a large one and was a good producer of silver many years ago. With depth the Nettie may develop large deposits of copper and zinc. There is a large area of zinc deposits extending for several miles from the Emma mine in Butte westward beyond the old Blue Bird properties. In the western section several copper properties have also been opened, but none were ever developed to an important producing stage. It is expected that the western section will be pretty thoroughly explored and demonstrated through the work to be done in the Nettie by the Anaconda company, and the owners of other properties there are awaiting results with interest.

SALT LAKE CITY—Sept. 9

Dissolution of the Tintic Smelting Co. was begun on Aug. 31, in a petition filed with Judge A. B. Morgan of Provo. The petition was signed by Jesse Knight, J. William Knight, C. W. Nibley, W. Lester Mangum and R. E. Allen, who represented 4844 shares of stock out of a capitalization of 5000 shares. The petition states there is no opposition to the dissolution. The company was organized in 1906 and built a smeltery at Silver City to treat ore of the Knight mines and other properties in the Tintic district. The plant operated for a short time, several years ago, but on account of not having common-point freight rates, and other matters, did not earn a profit. Since that time the smeltery has been dismantled and a part of the machinery sold. The Tintic Milling Co. controlled by the Knight-Dern interests, is building its new mill at the former smeltery site.

Utah Copper Co. Produced in July 14,641,009 lb. copper, and the August production is estimated to be of about the same amount. Production for the four months just ended will exceed that for any similar period since the beginning of operations; with the July output as given above, the August output estimated at the same rate, the May output amounting to 14,053,765 lb., and that for June to 14,730,912 the total is between 57,000,000 and 58,000,000 lb., making a yearly rate of 171,000,000 lb. Additional dumping ground for tailings has recently been acquired by the company near the Arthur and Magna mills, the purchase price having amounted to about $50,000. There are buildings on a part of the ground, which may be used for dwellings for employees. On the south side of Carr Fork the company is constructing five 6-room houses for the use of the assistant superintendent of the mine, the assistant mining engineer, and others. These houses will be made accessible to the Bingham & Garfield depot by a new road from the south side of the cañon.

SEATTLE—Sept. 8

British Columbia Zinc Properties are entering the most important period of their development. After being considered a misfortune to be avoided and penalized, zinc promises to become a basic source of British Columbia mining wealth and scores of properties that have been idle for years, because of their large zinc showings, are entering the active list. These facts are indicated by developments reported from various points in British Columbia. A feature of the general revival of zinc was the recent bonding of the Big Ledge property at Halcyon, B. C., by English interests from L. L. Tower, of Northport, and associates. The Consolidated Mining & Smelting Co. has begun the erection of the zinc-reduction plant and it is announced that the entire output of the new works at Trail will be taken by the Dominion government until the end of the war.

Yukon Gold Production will reach $5,000,000 this year according to the latest estimates. Last year's production is now definitely established at $4,750,000, which shows that the 1915 production is little more, principally for the reason that the largest dredge in the district—Canadian-Klondyke No. 2, which overturned last October—has not been in operation on account of undergoing repairs. Another dredge, which worked most of last year on Bonanza, is idle this year. Notwithstanding the idleness of these two dredges, the other boats are making a good showing. The Yukon Gold Co. fleet has been doing exceptionally well and the Canadian-Klondyke's three dredges have been in some of the richest ground this year that they have ever worked. The gold produced in the Klondike camp now by dredges comes chiefly

from the Klondike River between Bear and Bonanza Creeks, and from Bonanza, Eldorado, Hunker and Gold Run Creeks. The largest hydraulic operations are along Bonanza benches and Eldorado benches.

KELLOGG, IDAHO—Sept. 8

Cœur d'Alene Mines Employ About 5,000 Men at present, the largest number in the history of the camp. Nearly 4,000 of these are with the larger companies, and it is estimated that there are another thousand scattered over the district on smaller properties. The larger mines, tributary to Wardner and Kellogg, employ 1,450 men distributed as follows: Bunker Hill & Sullivan, 650; Ontario, 150; Caledonia, 50; Last Chance, 300; Stewart, 300. The mines tributary to Mullan employ 665 men as follows: Morning, 450; Hunter, 150; National, 50; Reindeer-Queen, 15. The mines tributary to Wallace employ 1,850 men, distributed as follows: Hercules (Cañon Creek), 450; Hecla (Cañon Creek), 175; Marsh, (Cañon Creek), 100; Green Hill-Cleveland (Cañon Creek), 325; Frisco (Cañon Creek), 100; Tamarack-Custer (Cañon Creek), 225; Success (Ninemile), 125; Interstate (Ninemile), 350.

Rex Consolidated is assuming importance as a new Cœur d'Alene mining company. Charles Sweeny, formerly of the Federal Mining & Smelting Co. has joined the board of directors and will be a member of the executive committee of the new company, with his son, Robert Sweeny, and W. J. Hall, a former director of the Federal company. The other directors of the Rex company are M. J. Sweeny, a brother of Charles Sweeny, and Peter Bernier, president of the Black Bear Consolidated, which recently passed to the control of the Rex company. It is reported that the board is to be joined soon by a New York capitalist, and that it is the intention to make of the Rex another organization like the Federal company. With this object in view the directors are said to be negotiating for two more Cœur d'Alene properties in addition to the Rex and Black Bear.

The Consolidated Interstate-Callahan property, the youngest and richest of the Cœur d'Alene mines, may be placed in the hands of a receiver as an outgrowth of the fight for control at the last annual meeting, held in Duluth on Aug. 16. The Callahan-Boutin faction were unable to vote 170,000 shares held by the Callahan Mining Co., which would have given the insurgents control, and as a result two sets of directors were elected. The Robbers-Percival-Sussman faction, identified with the American Metal Co., is in physical control of the property, and a plea for a receiver was filed in the district court at Wallace on July 27 by the opposition. The complaint alleges that the Callahan company and Frank Boutin "believe that the officers of the American Metal Co. will control the Consolidated Interstate-Callahan Co. and its property for its own benefit and to the loss and injury of the Consolidated Interstate-Callahan Co. and its directors." It is further alleged that the American Metal Co. obtained an unfair contract for a period of 10 years for practically all the output of the Interstate-Callahan, whereby the latter company is receiving and will receive much less than its ores would bring from other smelters. The contract is said to call for a flat rate of $38 a ton for all concentrates. Judge Woods has appointed as receiver Eugene R. Day, of the Hercules. Meanwhile. attorneys for the present management have raised the point that, since the Interstate-Callahan is not an Idaho corporation, the state courts have no jurisdiction and that the case must therefore go before the Federal courts. Pending action on the motion in the Federal court, the receiver is not now in possession, and will not take charge of the property unless the motion is decided in favor of Boutin and associates. Indications are that the contest will be long drawn out and bitter, and the prediction is made that the issues involved will go to the U. S. Supreme Court for final settlement.

DULUTH, MINN.—Sept. 11

The Oliver Iron Mining Co. on Aug. 30 requested and received permission to contribute $70 monthly to the state school at Owatonna, Minn., for the care and maintenance of several children of Paul Paulson, deceased. The man was killed while in the employ of the company, and the latter voluntarily paid the widow $5,000, being the legal limit. Desirous of doing more than the legal requirements the company is now assisting in the education of the children.

Leased State Iron Mines will ship 2,000,000 tons, this season, according to the estimates of State Auditor J. A. O. Preus. The record season was 1913, when 2,875,982 tons went forward. According to the records there is an estimated tonnage of 144,000,000 still remaining. Deposits making up this tonnage are contained in the area covered by 47 leases, which have an average of 34 years still to run, thus making the average output required to exhaust these mines about 4,250,000 tons. State leases carry a royalty of 25c. per ton, so there is a total royalty of $36,000,000 in sight for the state, which goes to the state's permanent school, university and swamp-land funds.

Iron-Ore Cargoes were leaving the Duluth-Superior harbor at rate of one every hour during the first week in September. At the Ashland, Wis., docks, where much Michigan iron ore is loaded, both the C. & N. W. and the Soo docks are handling exceedingly heavy tonnage. The August shipments down the lakes totaled 8,081,117 tons, being the second largest tonnage of ore delivered in a single month on the Great Lakes. From now on, weather conditions will interfere somewhat with shipments, and it seems that the flood tide of ore tonnage is past. Competent judges state that the season's shipments will scarcely exceed 45,000,000 tons.

Additional Rail Service for the Minnesota Steel Co.'s plant will be provided by the Duluth, Missabe & Northern Ry., which has leased the trackage of the Spirit Lake Transfer Ry., Interstate Transfer Ry. and the Duluth Terminal Ry., giving it the best terminal facilities of any of the Duluth rail lines. The transaction gives the Minnesota Steel Co.'s plant rail service on both sides and through its plant, and facilitates the handling of material to and from the Missabe docks, in Duluth. The lease also offers a reasonable solution as to why the steel company had not constructed docks for direct lake shipment. The D., M. & N. Ry., being a subsidiary of the U. S. Steel Corporation, now affords the latter unexcelled terminal and dockage facilities at the head of the lakes.

HOUGHTON, MICH.—Sept. 15

There is Not the Feeling of Optimism relative to the copper situation in the Michigan district that was evidenced a month ago. There are not, however, any accumulations of metal here. Certainly none that compares with this season in previous years. Most of the companies are sold through the present month of September but the fact is acknowledged that there have ben no heavy bookings beyond that date. It may be a waiting game. If such is the case there is every reason for believing that the large copper producers are in just as good condition to withstand lowered prices as are the consumers.

The Social-Welfare Idea, originating in this district in the Calumet & Hecla's long maintained policy of looking after the men with an almost paternal attitude, is impressing other corporaions in the Lake country. It may be noted that during the recent visit of John Stanton, head of the Wolverine and Mohawk properties, there was an evening reception to 100 heads of departments from the mines and mills, at which Mr. Stanton gave a fine address on the policy of "getting together" for mutual benefit. These same companies continue to pay their monthly bonus checks of 5% to the men. Calumet & Hecla continues its 10% advance in wages, over and above the $500,000 distributed in bonuses in July.

TORONTO—Sept. 11

Important Phosphate Deposits are reported to occur in the Banff National Park in the Rocky Mountains, according to Dr. Frank D. Adams, chairman of the committee on minerals of the Canadian Conservation Commission, and W. J. Dick, mining engineer of the commission. The discovery is regarded as of great importance in connection with the agricultural development of the West. The distribution and extent of these deposits will be studied by the Department of Mines.

The Sesikinika Gold Area has latterly attracted a good deal of attention and many American capitalists are acquiring interests in claims. A Buffalo syndicate has purchased the Malory claims adjoining the Labine for a figure stated at $35,000, and development is progressing in charge of J. Nelson of Haileybury. Frank Loring and associates are working the Gibson-Potvin claims at Goodfish Lake near Sesekinika, having taken up the option at $65,000. The Goodfish Lake Gold Mines Co. are operating the Costello claims, with excellent showings on partly developed veins.

The Kowkash Excitement shows no signs of abatement. The rush of prospectors and speculators, many of them from distant points, is unprecedented in the mining history of northern Ontario. A large area in the neighborhood of E. W. King Dodd's discovery has been staked, though some doubts are expressed as to whether there is much valuable territory outside of the original claim, from which all the rich gold samples that are being shown have been taken. The Ontario Bureau of Mines here is overwhelmed with applications for maps and information. Percy Hopkins, assistant provincial geologist, has been sent by the Bureau to Kowkash to make a preliminary investigation of the formation and mineralogy of the district. T. A. McArthur, inspector of mining recorders' offices for Ontario, has also been sent up to look into the situation and ascertain whether it is advisable to open a recording office in the district, as at present Port Arthur is the nearest point at which claims can be recorded. The department is preparing a map of the Kowkash field on a large scale, which will be issued in about two weeks.

The Mining News

ALASKA

SKEEN-LECHNER (Seward)—These properties sold at receivers' sale. Mill sold to L. V. Ray and mining claims to Harry Hobem.

FRANK SKEEN AND J. W. STEVENSON report finding a rich gold lode on the Champion and Gladiator claims in the Moose Pass district.

ALASKA-EBNER (Juneau)—New company formed in New York will probably start work on the Ebner and Hallum properties in the near future.

TAKU VS. GOLD BELT (Juneau)—Suit has been brought by the Taku Alaska company against the Alaska Gold Belt Co. regarding title to 11 claims.

LANDLOCK BAY (Valdez)—W. A. Dic ey has shipped $40,000 worth of copper ore from his claims this summer. Development work will be pushed.

WILLIAM BARTHOF (Knik) — The original locator of most of the Willow Creek claims expects to install a small mill next spring at the Mabel mine on Archangel creek, Willow Creek district.

ALASKA-JUNEAU (Juneau)—New system of shooting large stopes is being experimented with to lower cost of stoping ore. No results given out as yet. John Richards is mine superintendent; P. R. Bradley, general superintendent.

JUALIN ALASKA GOLD MINES (Juneau)—Jean Vanophem and party, having left Brussels by special permission from the German Government on business, are examining the Jualin properties with Consulting Engineer H. G. Young. Mr. Vanophem is president of the Algunican Development Co., which is handling the Jualin property. Last year Mr. Vanophem had just arranged for big work at the Jualin when the war broke out and tied up the Belgian capital that was to be used in the work. No word is given out as to the magnitude of the work now contemplated.

ARIZONA

Gila County

IRON CAP (Globe)—Williams shaft will be put down from 8th to 10th level at once, and a larger hoist installed in near future.

Greenlee County

WESTERN FEDERATION OF MINERS has started strike for increased wages in the Clifton-Morenci district. Mines and reduction works of Detroit, Arizona and Shannon companies closed and 8,000 miners, machinists and electricians reported on strike. Company managers have declined to meet Western Federation representatives.

Mohave County

PAYROLL (Chloride)—Considerable new equipment is being installed by Thomas B. Scott.

NEW JERSEY (Chloride)—The mill is being remodeled and will soon be in commission.

OATMAN GOLD (Oatman)—This company reports cutting the Kokomo vein at a depth of 113 ft. Shaft still in ore at 130 ft.

GOLCONDA EXTENSION—Unwatering of the mine continues, the water having been lowered to the 180-ft. level. Sinking will soon be resumed.

E. R. HOLDEN, of E. R. Holden & Co., Cripple Creek, Colo., is planning to build a custom mill in the Oatman district to treat ores from the smaller mines.

TENNESSEE (Chloride)—Excellent ore has been opened on the 1,200-ft. level. The ore is being shipped to Utah. Shaft is being continued to the 1,500-ft. level.

JEROME-OATMAN (Oatman)—The company is installing a hoist, compressor, drills and drill sharpener. Several new buildings have been put up and roads built.

HAWKSHAW (Oatman)—E. H. Newland and N. C. D'Arcy of Colorado have taken over the Lucky Boy-Hawkshaw group of six claims and the controlling interest in the Tom Reed Annex.

Pinal County

RAY-ARIZONA (Kelvin)—The company is patenting its ground and will soon resume active operations.

WERNER (Price)—A mill is being erected on the property. A pipe line delivers water from the Gila River.

RAY-HERCULES (Ray)—About 40 men are already at work on the property making surface improvements.

KELVIN-SULTANA (Kelvin)—The No. 2 vein has been reached by the crosscut on the 500 level. Drifting east and west will be begun, and the crosscut continued southward.

CALIFORNIA

Eldorado County

BLUE ROCK (Georgetown)—New 10-stamp mill completed by James Flynn. Mine is near Georgia Slide.

FOWLAR (Placerville)—Smooth slugs of coarse gold ranging in value from $5 to $74.50 have recently been cleaned up at this gravel mine on Otter Creek.

Fresno County

COPPER KING (Academy)—Property leased to Charles Leavitt, of Fresno. Unwatering shafts and drifts and a general cleanup of surface has begun. Reported that about 8,000 tons of copper ore is in sight.

Humboldt County

FRANK LUBBS (Scotia)—Has uncovered 18-in. vein of high-grade milling ore on placer claim near the Red Cap.

RED CAP (Scotia)—Lower tunnel is in 312 ft. and a 15-ft. crosscut has been driven which is in a diorite dike that parallels the vein.

MOUNTAIN LILY (Scotia)—Good body of milling ore has been disclosed above tunnel No. 2. The arrastre will run on this ore during winter.

Inyo County

MANGANESE ORES from a deposit said to be 100 ft. wide are being mined and shipped by Alexander Yeoman. Ore carrying 50% manganese is shipped to Baltimore, Md. Auto-truck haulage to the railroad costs $7.50 per ton; railroad freight to San Pedro $2.50 per ton and water freight via Panama Canal $4 per ton; extraction of the ore costs about $1 per ton, making a total cost of about $15 per ton.

SILVER KING MINING CO.—(Darwin)—Lease taken on the Lee mine by D. F. Shiveley, D. E. Staats, E. E. Simmons and J. H. Kohlbecker, who formed the above company. Zinc ore will be shipped at present.

CERRO GORDO (Keeler)—Aërial tramway has been rebuilt and is delivering more than 100 tons of zinc ore per day at Keeler. In four months, March, April, May and June, 1,681 tons of zinc ore were mined; zinc content, 1,109,481 lb. Most of this ore came from the 200, 400 and 500 levels. The vertical shaft has reached the 950-ft. point, from which a 250-ft. winze has been sunk.

CARBONATE (Zabriskie)—Ten auto trucks are employed hauling ore to the Tonopah & Tidewater R.R. Trucks carry from 4 to 6½ tons each. Additional trucks have been ordered. Haulage costs about $12 per ton over a distance of 42 miles. Reported that the ore runs about 37% lead, 20 oz. in silver and $5 per ton in gold. The mine has about 900 ft. of development, principally adits at a vertical depth of about 200 ft. The vein varies from 2½ to 15 ft. in width and is easily mined. John Salsberry is manager.

Kern County

OLD MILL (Caliente)—Los Angeles men offered to renew option for antimony claims. Shipment of ore to Magnolia Metals Co. of New York arranged for. Other mines in Amalie district reported to have contracted for shipments to same company.

Nevada County

GOLDEN CENTER (Grass Valley)—First dividend of 4% has been declared. The property has been in operation since June, 1914. New hoist in course of erection.

BAGLEY (Grass Valley)—Clyde G. Carr, formerly manager Candelaria Mining Co. of Nevada, and Howard Dennis, of Grass Valley, have bonded this property and retimbered the old shaft down to former tunnel level.

Plumas County

PLUMAS-EUREKA MINES CO. (Johnsville)—Voluntary petition in bankruptcy filed in the U. S. District Court, Aug. 28. Liabilities $133,633, assets $41,515. Principal creditors George W. Phillips, of Massachusetts, and Scheeline Bank and Trust Co. of Reno.

Shasta County

KEYSTONE DREDGING CO. (Kennett)—Reported to have purchased from W. P. Hammon 500 acres of land on west side of Sacramento River two miles above Kennett.

BELL COW (Ono)—Development work on the property on Arbuckle Mountain, west of Ono, progressing with satisfactory results. Grade of ore increasing as depth gained; some high-grade ore opened.

Siskiyou County

VICTORY GOLD MINES CO. (Etna)—New 50-ton tube mill being installed. J. E. Nefroney, superintendent.

Trinity County

UNION HILL (Weaverville)—Mine closed down for the season on account of lack of water.

GOLDEN JUBILEE (Coffee Creek)—Installing two Trent universal machines. Chester L. Proebstel, superintendent.

HORSE SHOE MINING CO (Lewiston)—Preparations being made to resume operations next season, under management of John M. Nicol.

UNION CONSTRUCTION CO. (San Francisco)—Paulsen's ranch, near Lewiston, being drilled. If ground warrants, dredge will be installed.

TONOPAH MINING CO. (Carrville)—Dredging ground being prospected with two Keystone drills. Walter J. Radford, of Breckenridge, Colo., is in charge.

Tuolumne County

HARVARD (Jamestown)—G. Musente, a miner, was probably fatally injured by being caught between the skip and the timbers at the collar of the shaft.

SPRINGFIELD TUNNEL (Sonora)—Angelo Bachich, a miner, was killed on Aug. 31 by fall of rock.

COLORADO

Eagle County

A STRIKE OF GOLD ORE is reported from a new area in the southern part of this county around the heads of Brush and Lime creeks. Nearest railroad station is Thomasville on the Colorado Midland. District has been named Fool's Peak.

Lake County

ROBERT BURNS (Leadville)—Development in this property near Little Jonny on Breece hill, is still within oxidized zone. Large body of copper carbonate has been opened. Recent shipments have ranged from 7% to 26% copper.

PENROSE (Leadville)—The motor of one of the Providence centrifugal sinking pumps that are unwatering downtown district burned out recently while in operation. During repairs, water rose about 5 ft. in the Penrose shaft despite operation of the other pump.

ALADDIN (Leadville)—Manager Walter W. Davis of the Yak company confirms announcement that his company has secured this group under bond. Exploration performed some time ago through a drift at foot of 200-ft. winze near the breast of Yak tunnel disclosed attractive showings of ore in Aladdin ground. From this drift a new winze will be sunk an additional 150 ft. to reach certain contact or ore zone and, if results are satisfactory, the tunnel proper will be extended into the new territory. While it will be above the ore-bearing formations, its depth from surface will be about 1,250 ft. since the bore will be well into the Mosquito Range.

Park County

LONDON (Alma)—Sixty leasers are working in this lofty, high-grade mine that had been shut down by owners. Four 6-horse teams are busy hauling ore seven miles to station for shipment to Denver. While tonnage from this vein cannot be great, ore is of high quality. First 300 tons marketed this summer averaged 6.5 oz. gold per ton. Ore also runs well in silver and copper.

San Juan County

HIGHLAND MARY (Silverton)—This mine is now in combination with Trilby and Shenandoah mines. Group will be managed by Mr. McLean who plans system of underground connections.

Teller County

HONDO (Victor)—Ore shipped from the Sitting Bull vein runs about $17 per ton.

W. P. H. (Anaconda)—Clutch lease has struck shoot, 4 ft. wide, of high-grade ore.

DOCTOR-JACKPOT (Anaconda)—Five sets of leasers shipping good ore. Starkweather & Wilson lease marketing 2-oz. ore, occurring in a shoot developed more than 100 ft. along the drift.

TRACHITE (Independence)—This United Gold Mines Co. property on Bull Hill makes increasing shipments from its new shaft now about 75 ft. deep, all rock broken being ore averaging about $15 per ton.

PORTLAND-INDEPENDENCE (Victor)—New trestle connecting Portland surface and dumps with top of Independence mill is completed. Remodeling of mill is in progress, six carloads of new machinery having been ordered and some of it already delivered. About 40 blocks of Independence ground are worked under lease.

ISABELLA (Altman)—August tonnage from this mine reached a record; leasers and company shipments amounted to 105 carloads having an average value of about $24 per ton. Among the leases making large showing were the Klondike or Knuth and Theobold, Wolcott, and Dolzell and Comerford. The last-named lease has 7 ft. of high-grade ore.

TRAIL (Victor)—Being developed on 1200 level through Dexter shaft by Orrison & Eby. New orebody from 5 to 10 ft. wide and averaging about $30 a ton in gold has been opened up for distance of 200 ft. Leasers plan to do about 1200 ft. of drifting under stoping ground having depth of 700 ft. Robinson Leasing Co. is conducting its operations through Blue Bird shaft. Development is in progress on 1000 level where crosscut has been driven to cut trail vein and is now opening some encouraging pockets of ore.

LAST DOLLAR (Victor)—Joseph Crumby, leasing on 1,100 level, has settled carload shipment at $37 net per ton. On 1,200 level, leasers have opened a vein parallel to main Last Dollar vein but it has not been sufficiently developed to determine its character. Charles Ellison and James Constantine, miners engaged in shaft-sinking, were killed at the bottom of main shaft, Sept. 3, when the light rope—used temporarily in hoisting to the 1,200 level—broke and dropped the bucket containing them about 30 ft. into the blasts of 16 holes they had just fired.

GOLDEN CYCLE-VINDICATOR (Independence)—Carver lease, on Golden Cycle 400 level, maintains large output of $25 ore. Vein is 3 to 7 ft. thick and has produced steadily for a year and a half. Rust-Hayes lease, in Vindicator 1,100 level, ships high-grade ore from a vein having a core about 2 in. thick and extremely rich. Fish and Harris, Vindicator 700 level, are stoping in a shoot 4 to 7 ft. wide running about 1 oz. per ton. The Shatz leases in the Golden Cycle and Vindicator veins are both shipping. The Vindicator company has paid off 16 of its notes held by the Golden Cycle company. These notes have face value of $560,000, leaving notes amounting to $700,000 still to be met. Usual monthly 2% dividends are being paid by the Golden Cycle company.

IDAHO

Shoshone County

JACK WAITE EXTENSION (Murray)—Installing gasoline-driven compressor and will put on small crew for development work.

REINDEER-QUEEN (Mullan)—Ore bins are nearly finished and stoping on small shoot of high-grade ore will commence at once. Main drift advanced 200 ft. in August. Vein, crosscut for 35 ft., is said to average 2 to 3% copper.

CARNEY COPPER (Mullan)—Two veins will be developed. Grading for new compressor has been completed and machinery will be installed at once. A contract has been let for driving No. 3 tunnel an additional 50 ft. No. 2 is in 1,500 ft.

BROWN & FINNELL (Kellogg)—Have cut a 12-ft. vein on their Pine Creek property assaying 40 to 70% antimony. They plan to install gravity tram, flume and sluice, to erect messhouse and bunkhouses, and to commence shipments as soon as possible.

NATIONAL (Mullan)—A shaft has been sunk from the main tunnel 200 ft. along the hanging wall. Vein will now be crosscut and explored by drifts. Quality of the ore is much improved in shaft, assays returning 37.7 oz. silver, 8.8% copper and $1.40 in gold. Mill will be started by Sept. 15. G. F. McCarthy, manager of Hecla mine, is in charge.

EVANS (Wallace)—Benjamin Evans, who has installed a Franz table for reworking the slime tailings below the Interstate-Callahan mill on Ninemile, is recovering from 3 to 5 tons of zinc concentrates a day. One 50-ton car was shipped Aug. 31 and it was planned to ship another by Sept. 10. Tailings are abnormally rich on account of the crowding of the Interstate mill to take advantage of high zinc prices.

CARBONATE HILL (Mullan)—It is understood that bond on this property four miles east of Mullan was taken for Butte & Superior company of Butte. Bonded Aug. 30 for $587,630, the first payment of $75,000 to be made on Sept. 1, 1916, and payments of equal amount to follow at intervals of three months, the final payment of $62,630 to be made on Oct. 1, 1918. Recent strike shows 4 or 5 ft. of high-grade zinc ore, accompanied by considerable lead; rest of vein, probably 10 ft., is lower grade ore. Since making strike, vein has been explored over 100 ft.

MICHIGAN

Iron

WALPOLE (Iron Mountain)—This mine being prepared for active operations. Some miners at the Pewabic will be transferred, and mine may be worked all winter.

SOUTH JACKSON (Negaunee)—Property has worked steadily all summer. Mine is only worked during summer. The ore is in good demand and more could be sold if it could be taken out.

ELECTRIC POWER for the Michigan ranges may be secured from a water power on the Flambeau River, 15 mi. northeast of Ladysmith, Wis., by a Boston syndicate headed by William H. Burgess. A dam is to be built creating a 68-ft. head for the development of 10,000 hp.

MAAS (Negaunee)—At the opening of navigation there were over 300,000 tons of ore in stock here. All but about 25,000 tons will be shipped. This will be left to support the trestles. Working with one full crew. Both this and the Negaunee, which adjoins, will be worked all winter.

MINNESOTA

Cuyuna Range

CUYUNA-DULUTH (Ironton)—Pres. W. H. Locker announces that this underground operation will be resumed shortly. Has been idle over a year.

ADBAR DEVELOPMENT CO. (Brainerd)—Company has started sinking a plank-lined shaft on its property in Sec. 22, 45-30, four miles east of Brainerd. The orebody is covered by till to a depth of 100 ft. The operation is a pioneer in its vicinity, the Wilcox mine two miles eastward being its nearest neighbor.

ROWLEY (Barrows)—Following customary Cuyuna Range plan, an excursion of stockholders (and others) was run from Duluth to shaft site at Barrows on Sunday, Aug. 22. Shaft was duly christened with spring water (the district being "dry"); the mine's namesake turned first shovel of dirt; ladies of town served dinner in grove on property; and excursion then visited other places of interest on Range. Property is held on lease from Northern Pacific Ry. Co. and contains comparatively small body of ore of good grade.

Mesabi Range

UNION (Virginia)—Recently 96 cars of ore were loaded in six hours by a single steam shovel. Said to be a record.

MONROE (Chisholm)—"A" shaft concrete lining now completed. From this shaft the village of Chisholm will procure its water supply from an unused portion of the workings.

Vermilion Range

DULUTH, MINN.—After years of litigation, Jacob and Amelia Stubler, of Duluth, have established title to a one-twelfth interest in a 40-acre tract adjoining the Grant Mine, at Buhl, on Mesaba Range. Tract is valued at $3,000,000. The acquisition came as result of purchase of the one-twelfth interest for $7.25 at forfeited tax sale in 1899.

MISSOURI-KANSAS

JOHN BARNES has encountered ore at Baxter Springs, Kan., at a depth of 15 ft., and already has a 5-ft. face with good ore in bottom of shaft. Will have to install pump, before going deeper.

SAVAGE (Galena, Kan.)—This mine on the Foster land, west of Galena, has been leased to Weir, Pepper and Vo, of Webb City, Mo. A mill will be built.

QUICK EIGHT (Galena, Kan.)—First car of ore shipped last week from 120-acre lease on the Glock land. Work is in new ground at 85-ft. level. W. A. Swan, superintendent.

LA NORA (Carterville, Mo.)—This mine on the Higgins land has been sold for $30,000. A drill will be put to work immediately to prospect the south part of the 52 acres. Meantime work will be continued at the old mine. George Bayless, superintendent.

MONTANA

Broadwater County

BLACK FRIDAY (Radersburg)—In view of proposed railroad from Three Forks to Radersburg, development work has been resumed to add to the ore reserves of 20,000 tons of milling rock. Gold veins vary from 2 ft. to 28 in. in width.

Jefferson County

MONARCH MINING AND MILLING (Clancey)—Work on King Solomon mine, a gold-silver-lead property recently acquired by this company, has progressed to such an extent that ore will be shipped regularly. Manager Moreland, after unwatering mine, has blocked out ore on 400-ft. level which will be tapped with 125 ft. of drift and crosscut. More men will be employed.

Granite County

GRANITE BI-METALLIC (Philipsburg)—Director John P. Meyer, after spending four months at mine, states that since development work was resumed another vein has been discovered, carrying from 60 to 90 oz. in silver and $3 to $5 in gold per ton. There is much low-grade ore on property.

Silver Bow County

BUTTE & SUPERIOR (Butte)—August was another record breaker. Total amount of zinc produced was 14,500,000 lb., nearly 1,000,000 lb. in excess of any previous month. Increase was brought about largely by increased efficiency from new machines in oil-flotation plant. Recoveries averaged 93%, while grade of concentrates was 56%, against 51% in former months.

TUOLUMNE (Butte)—Since unwatering shaft a few days ago, mining has been prosecuted vigorously and shipments have averaged 100 tons daily. This will be increased in near future. The 2,600-ft. level which was just beginning to show up well when mine was shut down, 10 months ago, is being further developed.

RAINBOW DEVELOPMENT (Butte)—Work of unwatering has shown no important damage was done to shaft. Company will push development work rapidly, three shifts having been put to work. Shaft is now down 1,300 ft. and will be sunk at least 200 ft. more.

NEVADA

Esmeralda County

KEWANAS (Goldfield)—A large low-grade vein was opened at a depth of 838 ft., at a point 200 ft. north of the winze from the east crosscut on the 700-ft. level of the Laguna shaft of Goldfield Consolidated.

KLONDYKE PORTLAND MINES CO. (Goldfield)—This recently organized company will run a crosscut from the 150-ft. shaft on its property in the Klondyke district, midway between Tonopah and Goldfield. M. F. Hill, secretary.

Humboldt County

ORE TRANSPORTATION for the camp of Rochester was improved by the opening on Sept. 8 of Nevada Short Line extension up Rochester Cañon to the portal of the Friedman tunnel.

SEVEN TROUGHS COALITION (Seven Troughs)—August production was only $48,000 owing to accident to engine. A 20-in. high-grade vein was opened on 1,200 level and record output would have been made in August but for accident. New 100-hp. gasoline engine has been installed.

ROCHESTER MINES CO. (East Rochester)—Most of the leases have been taken over by the company which is sending about 100 tons daily to the mill. New hoist on 300 level in Crown Point No. 1 was connected up on Sept. 8 and the Big Four winze, now down 160 ft., is supplying good ore from the 450-ft. level.

Lyon County

NEVADA-DOUGLAS (Ludwig)—Machinery of the new leaching plant is being given preliminary tryout.

Mineral County

PAMLICO PLACER CO.—This company has been formed by Sen. Key Pittman and S. H. Brady to operate placer claims at the junction of Neversweat and Pamlico creeks, 9 mi. southeast of Hawthorne. Washing plant and hoist will be installed.

Nye County

TONOPAH ORE PRODUCTION for the week ended Sept. 4 was 9,907 tons, of which Tonopah Mining produced 2,750 tons; Belmont, 3,187; Extension, 1,800; West End, 826; Jim Butler, 1,100, and miscellaneous leasers 244 tons.

BIG PINE (Manhattan)—The drift from the 200-ft. level of the Mushet-Wittenberg working shaft to the southern limits of the claim has been passing through the ore zone ever since leaving the shaft. The average of the drift face during this development was $5 per ton.

MANHATTAN-MUSTANG MINING CO. (Manhattan)—The sensation of the week was the phenomenal strike of high-grade ore in the Train-Chase lease on the Mustang. A series of vug holes containing a soft decomposed quart and talc averaged over $200 per ton. The ore is found in the limestone, but close to the shale contact, about 15 ft. below the surface. Following another small seam, with a winze, the ore makes directly against the hanging wall of shale and the leasers have carried the winze to an incline depth of about 18 ft. From the winze about 10 tons of high-grade ore has been taken and the chute is as strong in the bottom of the winze as elsewhere.

Storey County

MEXICAN (Virginia City)—East and west crosscuts on 2,700 level extended through porphyry and quartz of low assay. Mill treated 172 tons ore averaging $6.55 per ton.

JACKET-CROWN POINT-BELCHER (Gold Hill)—Saved 40 cars ore from Belcher 1,300 level and 13 cars low-grade from Crown Point crosscut. Jacket mill received 676 tons dump rock and 156 tons mine ore.

UTAH

Cache County

A NEW ZINC DISCOVERY is reported 3½ mi. southeast of Hyrum, near the mouth of Blacksmith Fork Cañon. Zinc-carbonate ore of good grade has been opened in the old Moon mine, which years ago was worked as a gold prospect. The ore occurs in limestone, and the mineralized zone can be traced some distance up and down the valley. A shipment of 21½ tons has been made by J. Nolan and C. C. Manghan, of Logan.

Juab County

TINTIC SHIPMENTS for the week ended Sept. 3 amounted to 131 cars, by 16 shippers. The Chief Consolidated, Iron Blossom, Centennial-Eureka and Eagle & Blue Bell had the largest output.

YANKEE CONSOLIDATED (Eureka)—The recent strike at this property is attracting interest among Tintic operators, and work is being done on the north and south in search of an extension of the ore.

Salt Lake County

NEW UTAH BINGHAM (Bingham)—Vein No. 4 in the 150-ft. level is 4 ft. wide with 14 to 24 in. of ore on the hanging wall. Ore in bin from raise on this vein assayed 25% Pb., 20 oz. Ag., $2 Au., 4% Cu. Main drift beyond No. 3 and No. 4 veins has encountered 2 ft. of $18 ore.

Weber County

WESTERN ZINC (Saline)—This company has taken a lease on a portion of the Lake View Mining Co.'s property on Promontory Point, and is doing active development work. J. C. Dick is manager. The Lake View company has shipped zinc ore valued between $25,000 and $30,000 since March and has paid $10,000 in dividends.

WISCONSIN

Zinc-Lead District

BELL (Platteville)—Shaft sinking has been started.

LONGHENRY (Benton)—Longhenry Brothers have started milling on the Spensley lease.

STAR (Platteville)—This company has acquired the Grant County mine and mill and begun operating.

VINEGAR HILL (Platteville)—This company has taken over the Hodge mine recently unwatered by the Ben Webster Mining Co.

LAKE SUPERIOR (Shullsburg)—This company of northern Wisconsin people has resumed operations at Shullsburg, after several years' idleness.

MILWAUKEE MINERAL (Highland)—Platte Whitman, of Highland, has purchased the property of this company and will begin mining operations.

GRITTY SIX (Cuba City)—A Chicago company has taken options on the Gritty Six, Raisbeck and Anthony properties and has begun pumping at the Gritty Six mine.

CANADA

British Columbia

YREKA—This property on Quatsino Sound, dormant for some years, will be reopened by Fred J. Rollands, of Spokane.

IVANHOE (Sandon)—The concentrator was destroyed by fire on Aug. 30. The plant, valued at $50,000, was treating ore from Lucky Jim and Surprise mines.

SILVER CUP (Hazelton)—A second carload of ore has been shipped to Trail by Clothier Bros., leasing this property on Nine Mile Mountain. The ore ran 135 oz. in silver and 30% lead.

SWAMP CREEK—Report of rich strike on Swamp Creek near Barkerville, in the Cariboo district, has not been substantiated. C. W. Grain, gold commissioner, states that there is nothing to justify a stampede to the diggings.

Ontario

TECK HUGHES (Kirkland Lake)—Buffalo Mines of Cobalt has finally purchased control for 5c. per share. Power plant and 100-ton mill are to be installed.

TIMISKAMING (Cobalt)—The Nordberg hoist is being installed. It has a capacity for 8,000 lb. from 2,500 ft. and is the largest hoist in the camp.

PORCUPINE CROWN—Drifting is being done at the 600-ft. level on vein 4 to 5 ft. in width with low gold content. Vein on 500-ft. level shows marked improvement in width.

ZINC CO. LTD. (Welland)—This company, backed by the Weedon Mining Co., of Weedon, Que., is constructing an electrolytic refinery to have a capacity of 5 tons of spelter per day.

HOLLINGER—In sinking the main shaft, a vein, about 9 ft. wide, carrying ore stated to average between $8 and $9 per ton, has been cut. It is about 300 ft. to the southeast of the main vein and running parallel to it. Reported that mill will be enlarged to treat 2,000 tons per day.

DOME—The present shaft being entirely in ore, it has been decided to sink a new shaft on an incline between the office and the mill. The ore will be crushed to 6 in. underground and brought to the surface up the new shaft in skips. Production for August was 28,600 tons, yielding $133,928 or $4.68 per ton.

DOBIE (Munro Township)—Two gold bars, valued approximately at $50,000, were shipped on Sept. 1 by the Dominion Reduction Co. to the United States mint. The gold was produced from 750 lb. of ore, and it is estimated that the tailings contain gold to the value of $30,000. A previous shipment of about $26,000 was made to Cobalt.

AFRICA

Rhodesia

GOLD PRODUCTION in July is reported at 80,669 oz., being 3,400 oz. more than in June; total gold reported for the seven months ended with July, 519,409 oz., or $10,736,184. Other metal output for July was 16,214 oz. silver, 330 tons copper and 3 tons lead. The mineral production included 64 tons asbestos, 5,432 tons chrome ore and 35,832 tons coal.

The Market Report

Metal Markets

NEW YORK—Sept. 15

The week was characterized especially by a noteworthy improvement in the copper market toward the close. On the other hand, lead and zinc were dull and declining right through the week.

Copper, Tin, Lead and Zinc

Copper—During the first four days of the last week, the copper market was dull and disappointing. Copper was freely offered at 17½c., regular terms, and some small sales were reported at that price, with sellers over. Eastern producers are said to have sold at the same price in Western markets, and after paying the back freight, netted only 17.22½c. Some sales for export were made on the basis of 17⅛c., cash, New York. On Tuesday the market woke up and good sales were made at 17⅝@17¾c., regular terms, while business for Europe was taken at £86, equivalent to about 17.35c. here at the current rate of exchange.

Some of the larger producers did no business in this market, but made large sales out of warehouse in Europe of copper that had previously been sent over and stocked there. France was a large buyer. There was some Russian business but the buying for Russian account was very much muddled and transactions with its agents are difficult to manage. The domestic business of the week, especially of the last two days, included some round lots, which were taken to a major extent by the brass manufacturers, although wire drawers were also buyers.

Copper Sheets are quoted about 23c. per lb. for hot rolled and 24c. for cold rolled, with usual extras. Wire prices are unsettled; quotations may be put at 19@19½c. per lb. at mil,. The chief maker does not quote base price.

Tin—The market was dull and featureless.

Lead—There was such sharp competition for a relatively small order on Sept. 8, and it was taken at so considerable a cut in price, that the A. S. & R. Co. apparently became disturbed over the situation in lead, and on Sept. 9, reduced its price to 4.70c., thus undercutting the outside producers. However, they immediately came forward with offers to sell at 4.65c., and then at 4.60c., whereupon the A. S. & R. Co. reduced to 4.50c. on Sept. 14. Although this second cut has so far failed to stimulate much buying, the outside producers do not for the moment seem to be disposed to go any lower, and at the close the market had become firm at 4.50c.

Spelter—The aggregate business was relatively small. At the beginning of our week of record the market stood at 13@14c., sales of September metal being made at approximately the higher figure, and of November-December, at the lower. From day to day the market fell off a little. Some of the new and small sellers were rather insistent upon disposing of their product, although what they had to offer was not large. On the other hand, there are signs that unsold stocks are beginning to accumulate in the hands of certain of the older and larger smelters, who are not making any special effort to sell, considering that any upturn of the market would rapidly clean them out. It is quite certain, however, that the position of the spelter market is becoming very much easier with respect to early deliveries. The outstanding feature of the week was the offering of spelter for immediate delivery by the principal buyer. These offers were limited to consumers only. The full meaning of this move is not yet understood .

Sales of brass special spelter are reported at 16c.

Sales of prime Western spelter for delivery in the first quarter of 1916 were made at 11½@11¾ cents.

Zinc Sheets—Business has been on a considerable scale. The base price for carload lots is unchanged at $16 per 100 lb. f.o.b. Peru, Ill., less 8% discount.

Other Metals

NEW YORK—Sept. 15

Aluminum—Demand continues good, and stocks are lower than ever. The price is firm at 45c. per lb. for No. 1 ingots, and 50c. is reported asked for a round lot for early delivery.

Antimony—The market remains quiet and no large business has been done. Sales of ordinary brands, principally in small lots, have been made at 28@30c. per lb. Cookson's is held at about 45c. but is rather nominal.

Nickel—Quotations for ordinary forms are 45@50c. per lb., according to size and terms of order. A premium of 3c. per lb. is charged for electrolytic nickel.

Quicksilver—The market is rather quiet but pretty firm. New York price is $89@90 per flask of 75 lb., according to size of order. San Francisco reports by telegraph a fair but uncertain market; quotations $85@90 per flask. London price is off 10s. per flask, £16 10s. being named from both first and second hands.

DAILY PRICES OF METALS IN NEW YORK

Sept.	Sterling Exchange	Silver, Cts. per Oz.	Copper	Tin	Lead		Zinc
			Electrolytic, Cts. per Lb.	Spot, Cts. per Lb.	New York, Cts. per Lb.	St. Louis, Cts. per Lb.	St. Louis, Cts. per Lb.
9	4.6500	48⅛	17.12½ @17.37½	33¼	4.70 @4.80	4.55 @4.75	13.00 @14.00
10	4.6850	48⅜	17.12½ @17.37½	33¼	4.60 @4.70	4.50 @4.55	13.00 @13.75
11	4.6900	48¾	17.12½ @17.37½	33¼	4.60 @4.65	4.50 @4.55	12.75 @13.50
13	4.6450	48⅜	17.12½ @17.37½	33¼	4.55 @4.60	4.40 @4.50	12.75 @13.50
14	4.6550	48¼	17.35 @17.55	33⅜	4.50 @4.55	4.35	12.50 @13.00
15	4.6550	48½	17.35 @17.55	33⅜	4.50	4.35	12.50 @13.00

The quotations herein are our appraisal of the average markets for copper, lead, spelter and tin based on wholesale contracts for the ordinary deliveries of the trade as made by producers and agencies; and represent, to the best of our judgment, the prevailing values of the metals, reduced to basis of New York, cash, except where St. Louis is given as the basing point. St. Louis and New York are normally quoted 0.17c. apart.

The quotations for electrolytic copper are for cakes, ingots and wirebars. Electrolytic copper is commonly sold at prices including delivery to the consumers and is subject to discounts, etc. The price quoted for copper on "regular terms" is the gross price including freight to the buyer's works and is subject to a discount for cash. The difference between the price delivered and the New York cash equivalent is at present about 0.20c. on domestic business. The price of electrolytic cathodes is 0.05 to 0.10c. below that of electrolytic. Quotations for lead represent wholesale transactions in the open market for good ordinary brands. Quotations for spelter are for ordinary Prime Western brands. Only the St. Louis price is herein quoted, St. Louis being the basing market. We quote the New York price at 17c. per 100 lb. above the St. Louis price.

Silver quotations are in cents per troy ounce of fine silver.

Some current freight rates on metals per 100 lb. are; St. Louis-New York, 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1c.

LONDON

Sept.	Silver	Copper				Tin		Lead		Zinc	
		Standard		Electrolytic							
		Spot	3 Mos.	£ per Ton	Cts. per Lb.	Spot	3 Mos.	£ per Ton	Cts. per Lb.	£ per Ton	Cts. per Lb.
9	23 11/16	67	68	82½	17.11	152½	154	22 1/16	4.76	72	14.94
10	23⅝	67½	68½	82½	17.21	153¼	154¼	23 1/16	4 81	72	15.03
11	23 5/16	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	23 5/16	68¼	69½	82½	17.10	154½	155¾	23⅛	4.80	71	14.73
14	23½	68½	70	84½	17.54	153½	154¾	23 1/16	4 79	71	14.76
15	23 5/16	69⅛	70⅛	84½	17.54	152½	153½	22 15/16	4.76	68½	14.21

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2240 lb., except silver which is in pence per troy ounce of sterling silver, 0.925 fine. Copper quotations are for standard copper, spot and three months, and for electrolytic, price for the latter being subject to 3 per cent. discount. For convenience in comparison of London prices, in pounds sterling per 2240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at 4.80. £ 15 = 3.21c.; £20 = 4.29c.; £30 = 6.43c.; £40 = 8.57c.; B60 = 12.85c. Variations, £1 = 0.21½c.

Gold, Silver and Platinum

NEW YORK—Sept. 15

Gold in the United States, Sept. 1, is estimated by the Treasury Department as follows: Held in Treasury against gold certificates outstanding, $1,260,979,669; in Treasury current balances, $211,925,634; in banks and circulation, $583,826,835; total, $2,056,732,138, an increase of $50,332,599 in August.

Gold Sales from the New York Assay Office in August were $2,448,845, being $461,845 more than in July. For the eight months ended Aug. 31 the total sales were $21,900,416 in 1914 and $18,509,205 in 1915; a decrease of $3,391,211 this year.

Silver—The market has remained steady in London the past week around 23⅝d. Sellers have not been pressing and shipments from this side continue small. The U. S. Mint purchased 600,000 oz. on Sept. 10 and 500,000 on Sept. 14. The fluctuations in sterling exchange have affected the New York prices.

Coined Silver in the United States, Sept. 1, is estimated by the Treasury Department as follows: Standard dollars, $568,271,655; subsidiary coins, $185,887,011; total, $754,158,666. Of the standard dollars $483,764,000 are held in the Treasury against silver certificates outstanding.

Platinum—The market is strong though demand has been rather checked by the recent advance. A sale at $45 per oz. is reported earlier in the week, but today dealers hold at $48@50 per oz. for refined platinum, and about $54 per oz. for hard metal. The shortage of supplies has not been relieved as yet.

Zinc and Lead Ore Markets

JOPLIN, MO.—Sept. 11

Blende, high price, $83; base per ton 60% zinc, premium ore, $80; medium, $79@75; lower grades, $74@70; calamine, base 40% zinc, $75@50; average, all grades of zinc, $78.58 per ton. Lead, high price, $51.90; base price, $50 per ton of 80% metal content; average, all grades of lead, $51.23 per ton.

SHIPMENTS WEEK ENDED SEPT. 11

	Blende	Calamine	Lead	Values
Totals this week	11,127,980	898,730	1,825,790	$519,350
Totals this year	396,844,390	31,991,540	61,294,510	17,408,010

Blende value, the week, $443,030; 37 weeks, $15,072,260.

Calamine value, the week, $29,480; 37 weeks, $718,780.

Lead value, the week, $46,840; 37 weeks, $1,616,970.

Owing to the lower price offerings a large portion of the premium ore was withheld from market this week. It was not definitely known until midafternoon today what would be the high price offering for next week's delivery. Buyers inclined toward $75, but it was necessary to pay $80 to secure any portion of the better product.

The Granby Mining & Smelting Co. and lessees on the company's land, are carrying nearly 3,200 tons of blende and calamine for a stronger market. The total stock is approximately 5,700 tons.

PLATTEVILLE, WIS.—Sept. 11

The base price paid this week for 60% zinc ore was $75 per ton, one sale being reported at $77. Medium grades sold at $70 and low grades at $65 per ton base. No sales of lead ore reported.

SHIPMENTS, WEEK ENDED SEPT. 11

	Zinc Ore, Lb.	Lead Ore, Lb.	Sulphur Ore, Lb.
Week	4,597,640	.....	472,000
Year	133,901,080	4,463,160	19,200,710

Shipped during week to separating plants, 5,301,980 lb. zinc ore.

MONTANA ZINC ORE

During August the Butte & Superior Mining Co. mined and milled 45,140 tons of ore, producing 12,907 tons concentrates which averaged 54% zinc, the approximate content being 13,879,000 lb. zinc. The recovery is estimated at 91.6% for the month.

Iron Trade Review

NEW YORK—Sept. 15

Activity in the iron and steel trades has not abated, and conditions are practically unchanged, except that there is an improvement in domestic orders and more railroad buying.

The mills generally are busy and in some cases find it difficult to keep up with their orders. This is especially the case with some that are working on export business.

Pig iron continues to be strong and more active than for some time. There is good buying of basic pig at advanced prices, but foundry iron is rather slower. Not very much business has been done for next year.

Pig-iron production, which on Jan. 1 last was at the rate of about 18,000,000 tons a year, has now risen to a rate of 33,500,000 tons yearly. An unusually large proportion of the present iron-making capacity belongs to the steel works furnaces. Of the active capacity on Sept. 1 only 24.4% belonged to the merchant furnaces.

The United States Steel Corporation reports the total of unfilled orders on its books Aug. 31 at 4,908,455 tons, or practically the same as on July 31, the decrease being only 20,095 tons.

The final decree of the Circuit Court dismissing the suit against the Steel Corporation was filed at Trenton, N. J., Sept. 10. The United States has 60 days in which to appeal.

Pig-Iron Production shows a further increase in August. The reports of the blast furnaces, as collected and published by the "Iron Age," show that on Sept. 1 there were 249 coke and anthracite stacks in blast, having a total daily capacity of 91,075 tons of iron, an increase of 4,275 tons over Aug. 1. Making allowance for the charcoal furnaces, the estimated production of pig iron in the United States in August was 2,809,000 long tons; for the eight months ended Aug. 31 it was 17,636,300 tons. Of this total 12,943,250 tons, or 73.4%, were made by furnaces owned or operated by steel works.

PITTSBURGH—Sept. 14

The steel mills are falling farther behind in deliveries, despite the fact that strictly new business is relatively light and the orders booked are chiefly in the form of specifications on old contracts. Recent inquiries as to contracts for bars, plates and shapes for fourth quarter have elicited the reply from mills that such contracts would really involve deliveries in the first quarter, as the mills are filled up already, and 1.40c. has lately been named by such mills as care to quote at all. For weeks bars have been 1.35c. for delivery at mill convenience and plates and shapes have lately firmed up to that level.

The decrease of 20,085 tons in the Steel Corporation's unfilled obligations during August confirms what has been stated for some time, that the mills are so well filled that they are curtailing the contract obligations accepted. In July the corporation's obligations increased 250,344 tons and in June 413,598 tons.

Earnings of all the steel companies have been increasing rapidly. All estimates are that the Steel Corporation will report more than $40,000,000 for the current quarter, and some estimates run up to $48,000,000. Even with $40,000,000 the corporation could wipe out the deficit accumulated since the beginning of last year and have enough left for a 1% common stock dividend.

The war demand for steel is unabated as to total tonnage. A new feature is the sharp increase in demand for steel for large shells, 4-in., 5-in. and 8-in., the last named involving forged steel rather than the rolled rounds of which so large a tonnage is being made.

Idle railway cars decreased from 265,364 on Aug. 1 to 183,659 on Sept. 1 and a shortage is fully expected at crop-moving time. The railroads have lately been sounding the steel market as to 1916 deliveries, fearing they cannot get material if they do not early. The car shops are very busy, but can work out their present orders in a few months and a fresh burst of freight-car buying is expected for the near future.

Pig Iron—A sale of upwards of 1,000 tons of basic iron was made Saturday at $15, Valley, and yesterday a sale of 2,000 tons was made at the same figure. Producers have been quoting $15 for some time, but these are the first sales definitely reported. Foundry iron is strong but not in very active demand. Demand for bessemer is chiefly for export. There are several idle merchant furnaces in the Valleys and the question before the market now is whether advances can continue with these furnaces seeking to accumulate a back log of tonnage upon which to blow in. We quote: Bessemer, $16; basic, $15; foundry and malleable, $14.50@15, depending on delivery; gray forge, $14.25@14.75, f.o.b. Valley furnaces, 95c. higher delivered Pittsburgh.

Ferromanganese—It is understood that some of the English producers have resumed quoting $100 on contract, with time of delivery rather uncertain. The prompt market continues to fluctuate between $100 and $110 per ton.

Steel—The scarcity of steel, particularly openhearth, is daily growing more acute. Even Steel Corporation subsidiaries have paid $26 at maker's mill for basic openhearth billets, and any odd lots that can be found at this figure are quickly absorbed. There is no active demand for bessemer billets. We quote basic openhearth billets at $26.50@27, Pittsburgh, and bessemer billets nominal at $25@26. Sheet bars would hardly be sold at less than billets, but no buyers could be found at several dollars a ton less as prices obtainable for sheets or tinplates would not warrant paying the price. Rods are very scarce. Makers regard the market as $29@30, but there are practically no sellers at any price.

Foreign Trade of the United States in iron and steel and manufactures thereof is valued by the Department of Commerce as below for June and the fiscal year ended June 30:

	June		Fiscal Year	
	1914	1915	1913-14	1914-15
Exports	$18,927,958	$31,757,103	$251,480,677	$225,888,350
Imports	2,835,110	2,003,234	31,790,851	22,712,868
Excess exports	$16,092,848	$29,753,869	$219,689,826	$203,175,498

April, May and June showed heavy gains in exports, but not sufficient to offset the losses of the earlier part of the year. Imports showed a steady decline throughout the year.

FERRO-ALLOYS

Ferromanganese is quoted at $110@112.50 per ton for domestic 80% material.—**Spiegeleisen** has been sold at $27 per ton for 20%, at furnace.—**Ferrosilicon,** 50%, is quoted at $73@75 per ton at Pittsburgh. Bessemer ferrosilicon is from $20 per ton for 10% up to $24 for 14%, all at furnace.—**Ferrotitanium** is 8@12½c. per lb., according to size of lots and delivery.—**Ferrovanadium** is $2@2.25 per lb. of contained vanadium.

FOREIGN IRON

Pig-Iron Production in Germany in June was 993,496 metric tons, being 7,528 tons more than in May. For the six months ended June 30 the total make was 9,288,196 tons in 1914 and 5,534,337 in 1915, a decrease of 3,753,859 tons this year.

Steel Production in Germany in June was 1,080,786 metric tons, being 36,679 tons more than in May. For the six months ended June 30 the total production was 9,380,867 tons in 1914 and 6,121,889 tons in 1915; a decrease of 3,258,978 tons.

Pig-Iron Production in Canada for the first half of 1915 is reported by the American Iron & Steel Association as follows: Basic, 292,556; bessemer, 5,238; foundry, 59,646; other kinds, 9,385; total, 366,825 long tons. This compares with 263,542 tons in the second half of 1914, and 442,430 tons in the first half. Of the make this year 297,818 tons were for the use of the makers and 69,007 tons for sale as pig iron. There were 360,530 tons made with coke and 6,295 tons with charcoal as fuel. The province of Ontario made 205,368 tons, or 56% of the total, the balance being made in Nova Scotia and Quebec—chiefly Nova Scotia.

SAULT STE. MARIE CANALS

The total freight passing through the Sault Ste. Marie Canals in August was 10,540,781 short tons. For the season to Sept. 1 the total freight was: East bound, 28,721,967; west bound, 8,682,185; total, 37,404,152 tons, an increase of 2,788,193 tons over last year. The number of vessels was 11,766, showing an average cargo of 3,179 tons. Of these vessels 9,618 used the United States canal and 2,148 the Canadian. The mineral freights included were, in short tons, except salt which is in barrels:

	1914	1915	Changes
Anthracite	1,426,591	1,274,174	D. 152,417
Bituminous coal	7,990,621	6,552,627	D. 1,437,994
Iron ore	20,633,194	25,962,787	I. 5,329,593
Pig and m'f'd iron	173,907	118,360	D. 55,547
Copper	40,278	79,254	I. 38,976
Salt, bbl.	496,108	393,853	D. 102,255

Iron ore was 69.4% and coal 20.7% of the total freight reported this year.

IRON ORE

Eastern iron ore prices are rather stiffer, and some sellers have made small advances. Current prices are 7@7½c. per unit of iron, delivered at eastern Pennsylvania furnaces.

Lake ore shipments in August, as noted last week, were 8,081,117 long tons, an increase of 2,211,640 tons over August, 1914. For the season up to Sept. 1 shipments by ports are reported by the "Iron Trade Review" as follows:

Port.	1914	1915	Changes
Escanaba	2,465,692	2,935,862	I. 530,172
Marquette	1,049,791	1,773,653	I. 723,860
Ashland	2,079,776	2,801,219	I. 721,443
Superior	7,576,831	4,439,088	D. 3,137,743
Duluth	4,152,367	9,378,530	I. 3,226,163
Two Harbors	3,953,650	5,418,068	I. 1,464,408
Total	21,278,107	26,806,420	I. 5,528,313

Of the August shipments 6,504,987 tons, or 80.5% of the total, went to Lake Erie ports. Stocks on Lake Erie docks Sept. 1 were 7,118,847 tons, a decrease of 166,303 tons as compared with last year.

Duluth shipments were 35% of the total against 19.5% last year, while the Superior shipments fell from 33.6% of the total in 1914 to 14.3% this year.

Imports at Baltimore for the past week included 6,600 tons manganese ore from Brazil.

COKE

Coke production in the Connellsville region for the week is reported by the "Courier" at 391,310 short tons; shipments, 388,107 tons. Production of Greensburg and Upper Connellsville districts, 42,905 tons.

Connellsville Coke—There is inquiry for furnace coke for the first half of 1916, but with prompt coke available at $1.60@1.65 and operators feeling that they should obtain much higher prices for next year it is very hard for buyers and sellers to get together. There is much talk of sliding-scale contracts, a favorite idea apparently being to make coke $1.75 minimum with basic pig iron at $13.75, Valley, and settle each month on the basis of 5c. rise in coke for every 25c. rise in pig iron. Foundry coke is $2.30@2.60 for prompt and $2.40@2.60 for contract.

Anthracite Shipments in August were 5,330,831 long tons, being 396,622 tons more than in July, but 152,912 tons less than in August, 1914. For the eight months ended Aug. 31 the total shipments were 43,321,389 tons in 1914 and 41,860,340 tons in 1915, a decrease of 1,461,049 tons, or 3.4%, this year.

French Coal Production in 1914 is reported by the Comite Central des Houilleres at 29,786,505 metric tons, a decrease of 11,057,113 tons from 1913. The decrease is entirely due to the war operations, which cover important coal producing districts.

Imports of coal and coke into Chile in 1914 were, in metric tons:

	Coal	Coke	Total
Great Britain	527,576	9,588	537,164
Australia	516,889	6,720	523,609
United States	143,404	1,885	145,289
Other countries	69,690	28,718	98,408
Total	1,257,559	46,911	1,304,470

Owing to the opening of the Panama Canal and the stoppage of exports from Great Britain, it is expected that in 1915 there will be a large increase in American coal.

Chemicals

NEW YORK—Sept. 15

The general markets are steadier than they were, with fair demand reported in most lines.

Arsenic—Business remains rather quiet but the market is steady. Prices are about $3.50 per 100 lb. for large lots, up to $4 per 100 lb. for small orders.

Copper Sulphate—The market is steady, with a fair business doing. Prices are $7.25 per 100 lb. for carload lots and $7.50 per 100 lb. for smaller parcels.

Nitrate of Soda—The market is steady on a good business for the season. Prices are unchanged at 2.42½c. per lb. for spot and 2.45c. for futures.

Potash Salts—Imports of potash salts into the United States for the seven months ended July 31 are reported by the Department of Commerce as below, in pounds:

	1914	1915	Changes
Carbonate	12,351,589	8,582,016	D 3,769,573
Hydrate	4,718,257	2,028,142	D 2,690,115
Nitrate	1,917,047	14,855	D 1,902,192
Cyanide	301,175	862,127	I 560,952
Other potash salts	3,753,901	2,075,545	D 1,678,356
Total	23,041,969	13,562,685	D 9,479,284

Imports of crude salts used chiefly as fertilizers were as follows for the seven months, in long tons:

	1914	1915	Changes
Kainit	201,878	6,646	D 195,232
Manure salts	135,422	13,647	D 121,775
Sulphate of potash	27,765	10,101	D 17,664
Muriate of potash	142,896	56,721	D 86,175
Total	507,961	87,115	D 420,846

The large decreases shown were due to the interruption of shipments from Germany by the war.

PETROLEUM

Exports of mineral oils from the United States in June were 209,368,274 gal. For the fiscal year ended June 30 the total exports were 2,269,218,073 gal. in 1913-14, and 2,176,427,305 gal. in 1914-15, a decrease of 92,790,769 gal., or 4.1%, last year.

Oil prices are again advancing. An increase of 5c. has been announced in Pittsburgh, bringing the price up to $1.65 per bbl. for Pennsylvania grade.

Mining Companies—United States

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Acacia, g	Colo	1,438,989	$ 1	$ 122,004	Jan '11	$0.01
Adams, s.l.c	Colo	80,000	10	778,000	Dec. '09	0.04
Ahmeek, c	Mich	50,000	25	3,050,000	July '15	10.00
Alaska Mexican, g	Alas	180,000	5	3,489,381	May '15	0.20
Alaska Treadwell, g	Alas	200,000	25	15,435,000	Aug. '15	0.75
Alaska United, g	Alas	180,200	5	1,937,150	Aug. '15	0.40
Am. Zinc, Lead & Sm	U. S.	171,200	25	983,320	Jan. '14	0.50
Anaconda, c	Mont	4,992,500	25	97,741,875	July '15	0.50
Argonaut, g	Calif	200,000	5	1,660,000	June '15	0.10
Arizona Copper, pf	Ariz	1,426,120	1.20	2,121,274	May '15	
Arizona Copper, com	Ariz	1,519,896	1.20	18,461,338	July '15	0.24
Bagdad-Chase, g., pf	Calif	184,819	5	202,394	Jan. '09	0.10
Baltic, c	Mich	100,000	25	7,950,000	Dec. '13	2.00
Bingham N. H., c	Utah	228,690	5	408,564	Mar. '15	0.10
Bonanza Dev., g	Colo	300,000	1	1,425,000	Oct. '11	0.20
Brunswick, g	Calif	395,287	1	179,597	June '15	0.06
Bunker Hill Con., g	Calif	200,000	1	850,000	Aug. '15	0.02½
Bunker Hill & Sul., l.s	Ida	327,000	10	16,446,000	Sept. '15	0.25
Butte-Alex Scott, c	Mont	74,000	10	148,000	Oct. '13	0.50
Butte-Ballaklava, c	Mont	250,000	10	125,000	Aug. '10	0.50
Butte & Superior, z	Mont	271,136	10	1,700,348	June '15	3.25
Caledonia, l.s.c	Ida	2,605,000	1	650,300	Aug. '15	0.03
Calumet & Arizona, c	Ariz	617,385	10	21,559,443	June '15	0.50
Calumet & Hecla, c	Mich	100,000	25	126,250,000	June '15	15.00
Camp Bird, g.s	Colo	1,100,051	5	10,428,674	July '15	0.08½
Centen'l-Eur., l.s.g.c	Utah	100,000	5	4,050,000	Apr. '14	1.50
Center Creek, l.z	Mo	100,000	10	535,000	July '15	0.15
Champion, c	Mich	100,000	25	10,300,000	Aug. '15	1.00
Chief Consolidated, s.g.l	Utah	871,384	1	306,821	Aug. '15	0.05
Chino, c	New Mex.	869,940	5	5,175,560	June '15	0.75
Cliff, g	Utah	300,000	1	90,000	Jan. '13	0.10
Cliff, g	Alas	100,000	1	210,000	Oct. '13	0.01
Colo. Gold Dredging	Colo	100,000	10	650,000	Sept. '14	1.00
Colorado, l.s.g	Utah	1,000,000	0.20	2,570,000	Dec. '12	0.03
Columbus Con., g.s	Utah	285,540	5	226,832	Oct. '07	0.20
Commercial Gold	Ore	1,750,000	1	43,750	Dec. '10	0.00½
Con. Mercur, g	Utah	1,000,000	1	3,445,313	July '13	0.03
Continental, z.l	Mo	22,000	25	341,000	July '15	0.50
Copper Range Con., c	Mich	393,692	100	13,986,746	Oct. '13	0.75
Daly Judge, s.l	Utah	300,000	1	1,020,000	July '15	0.25
Daly West, s.l	Utah	180,000	20	6,606,000	Jan. '13	0.15
Doctor Jackpot, g	Colo	3,000,000	0.10	45,000	Mar. '11	0.00½
Doe Run, l	Mo	65,783	100	3,550,969	Dec. '13	0.76
Eagle & Blue Bell, g.s.l	Utah	893,146	1	401,916	Aug. '15	0.05
Elkton Con., g	Colo	2,500,000	1	3,579,460	May '15	0.02
El Paso, g	Colo	490,000	5	1,707,545	Feb. '14	0.10
Ernestine, g.s	N.M.	300,000	5	150,000	July '15	0.10
Fed. M. & S., com	Idaho	60,000	100	2,708,750	Jan. '09	1.50
Fed. M. & S., pf	Idaho	120,000	100	9,856,503	June '15	1.00
Florence, g	Nev	1,050,000	1	840,000	Apr. '11	0.10
Frances-Mohawk, g	Nev	912,000	1	546,000	Jan. '08	0.05
Free Coinage, g	Colo	10,000	100	180,000	Dec. '09	1.00
Fremont Con., g	Calif	200,000	2.50	258,000	Oct. '14	0.02
Frontier, z	Wis	1,250	100	146,202	Nov. '13	2.00
Gemini-Key'ne, l.g.s	Utah	5,000	100	2,305,000	Dec. '14	10.00
Gold Chain, g	Utah	1,000,000	1	130,000	May '13	0.03
Gold Coin of Victor	Colo	1,000,000	1	1,350,000	Feb. '09	0.02
Gold Dollar Con	Colo	2,500,000	0.10	100,000	Dec. '12	0.00½
Gold King Con., g	Colo	5,750,370	1	1,407,319	Dec. '11	0.03
Golden Cycle, g	Colo	1,500,000	1	4,080,000	Sept. '15	0.02
Golden Star, g	Ariz	400,000	5	140,000	Mar. '10	0.05
Goldfield Con., g	Nev	3,559,148	10	28,288,001	July '15	0.10
Grand Central, g	Utah	500,000	1	1,620,750	Sept. '14	0.05
Granite, g	Colo	1,650,000	1	270,000	Nov. '12	0.01
Hazel, g	Cal	900,000	1	971,000	Dec. '13	0.01
Hecla, l.s	Idaho	1,000,000	0.25	3,370,000	Aug. '15	0.02
Hercules, l.s	Idaho	1,000,000	1	5,725,000	June '15	
Homestake, g	S. D	251,160	100	38,150,986	Sept. '15	0.65
Horn Silver, l.s.z	Utah	400,000	25	5,642,000	Sept. '07	0.05
Iowa, g.s.l	Colo	1,666,667	1	233,499	Aug. '14	0.00½
Iowa-Tiger, g.s	Colo	3,000	1	9,250	Dec. '14	1.00
Iron Blossom, s.l.g	Utah	1,000,000	0.10	2,420,000	July '15	0.05
Iron Silver, s.l.g	Colo	500,000	20	4,950,000	Dec. '14	0.10
Jamison, g	Cal	390,000	10	378,300	Jan. '11	0.02
Jerry Johnson, g	Colo	2,500,000	0.10	187,500	Nov. '14	0.01
Kendall, g	Mont	500,000	5	1,505,000	July '14	0.06
Kennedy, g	Cal	100,000	100	1,831,001	Apr. '10	0.03
King of Arizona, g	Ariz	200,000	1	396,000	Aug. '09	0.12
Klar Piquette, s.l	Wis	20,000	1	259,000	Apr. '13	0.50
Knob Hill, g	Wash	1,000,000	1	70,000	Oct. '13	0.00½
Liberty Bell, g	Colo	133,552	5	1,559,179	Sept. '13	
Little Bell, l.s	Utah	300,000	1	75,000	Mar. '11	0.05
Little Florence, g	Nev	1,000,000	1	430,000	Jan. '08	0.03
Mammoth, g.s.c	Utah	400,000	2.50	2,300,000	July '13	0.05
Mary McKinney, g	Colo	1,309,252	1	1,169,308	July '14	0.02
May Day, g.s.l	Utah	800,000	0.25	220,000	Aug. '15	0.02
Mexican, g.s	Nev	201,600	2.50	161,910	June '14	0.75
Miami, c	Ariz	747,112	5	5,645,698	Aug. '15	0.75
Modoc, g.s	Colo	500,000	1	275,000	Dec. '11	0.01
Mohawk, c	Mich	100,000	25	3,575,000	Feb. '15	2.00
Monarch-Mad'a, g.s.l	Colo	1,000,000	1	40,000	May '11	0.01
Montana-Tonop., s.g	Nev	921,865	1	488,588	Dec. '12	0.10
Mountain, c	Cal	250,000	25	4,216,250	May '08	0.44
National, g	Nev	750,000	1	570,000	May '11	0.10
Nevada Con., c	Nev	1,999,457	5	18,226,345	June '15	0.37½
New Century, s.l	Mo	330,000	1	237,600	Oct. '09	0.01
New Idria, q	Cal	100,000	5	1,680,000	Apr. '14	0.10
North Butte, c	Mont	430,000	15	11,890,000	July '15	0.50
North Star, g	Cal	250,000	10	4,637,040	June '15	0.20
Old Domin'n, M. & Sm	Ariz	162,000	25	7,290,000	June '15	0.50
Ophir, s.g	Nev	201,600	3	2,068,360	Jan. '12	0.10
Opohongo, g.s.l	Utah	898,978	0.25	80,907	Jan. '13	0.02
Oroville Dredging	Cal	700,000	5	1,692,568	June '15	0.12
Osceola, c	Mich	96,150	25	12,660,425	July '15	3.00
Parrot, c	Mont	229,850	10	7,871,839	July '15	1.63
Pearl Con., g	Wash	1,909,711	0.05	181,422	Dec. '10	0.02
Pharmacist, g	Colo	1,500,000	1	7,500	Feb. '10	0.00½
Pioneer, g	Alas	5,000,000	1	2,041,526	Oct. '11	0.03
Pittsburgh-Idaho, l	Ida	803,000	1	216,810	Oct. '12	0.04
Pittsburgh Silver Peak, g	Nev	2,790,000	1	771,200	July '14	0.02
Portland, g	Colo	3,000,000	1	9,933,080	July '15	0.02
Quilp	Wash	1,500,000	1	67,500	Feb. '12	0.01

Mining Companies—United States—(*Continued*)

Name of Company and Situation		Shares Issued	Par	Dividends Total	Latest	Amt.
Quincy, c	Mich	110,000	$ 25	$21,227,500	June '15	$2.00
Ray, c	Ariz	1,485,333	10	3,814,995	June '15	0.37½
Republic, g	Wash	1,000,000	1	170,000	Nov. '12	0.01½
Rochester, l.s	Mo	4,900	100	190,846	July '12	0.50
Round Mountain, g	Nev	1,188,019	1	369,365	Aug. '13	0.04
Seven Troughs Coal., g	Nev	1,500,000	1	108,226	June '15	0.02½
St. Joseph, l	Mo	1,472,252	10	9,573,180	June '15	0.05
Shannon, c	Ariz	300,000	10	750,000	Jan. '13	0.50
Shattuck Arizona, c	Ariz	350,000	10	2,625,000	Aug. '15	0.50
Silver King Coal., l.s	Utah	1,250,000	5	2,909,885	July '15	0.15
Silver King Con., l.s	Utah	627 582	1	685,338	July '15	0.10
Sioux Con., s.l.g	Utah	745,389	1	872,097	July '11	0.04
Skidoo, g	Cal	1,000,000	5	365,000	Oct. '14	0.01
Snowstorm, c.g	Ida	1,500,000	1	1,192,103	Oct. '13	0.02
South Eureka, g	Calif	299,981	1	411,680	July '15	0.03
Standard Con., g.s	Cal	178,394	10	5,274,407	Nov. '13	0.25
Stewart, s.l	Ida	1,238,362	1	1,826,417	July '15	0.25
Stratton's Ind., g	Colo	1,000,000	0.60	456,625	Dec. '14	0.03
Success, z	Ida	1,500,000	1	780,000	Aug. '15	0.04
Superior & Pitts., c	Ariz	1,499,792	10	9,178,736	June '15	0.20
Tamarack, c	Mich	60,000	25	9,420,000	July '07	4.00
Tennessee, c	Tenn	200,000	25	4,756,250	July '15	0.75
Tomboy, g.s	Colo	310,000	4.85	3,709,395	June '15	0.24
Tom Reed, g	Ariz	909,555	1	2,443,757	Apr. '15	0.06
Tonopah Belm't, s.g	Nev	1,500,000	1	7,455,510	July '15	0.12½
Tonopah Ext., g.s	Nev	943,433	1	896,259	July '15	0.10
Tonopah of Nev., s.g	Nev	1,000,000	1	12,850,000	July '15	0.25
Tri-Mountain, c	Mich	100,000	25	1,450,000	Dec. '13	2.00
Tuolumne, c	Mont	800,000	1	520,000	May '13	0.10
Uncle Sam, g.s.l	Utah	500,000	1	495,000	Sept. '11	0.05
United Cop. Min., c	Wash	1,000,000	1	40,000	Nov. '12	0.01
United (Crip. Ck.) g	Colo	4,000,100	1	440,435	Jan. '10	0.04
United Globe, c	Ariz	23,000	100	2,265,500	June '15	6.00
United Verde, c	Ariz	300,000	100	35,497,000	Aug. '15	0.75
Utah, s.l	Utah	100,000	10	281,860	Dec. '10	0.02
Utah, c	Utah	1,624,490	10	28,650,671	June '15	1.00
Utah Con., c	Utah	300,000	5	8,850,000	July '15	0.50
Valley View, g	Colo	1,000,000	1	240,000	Dec. '10	0.04
Victoria, g.s.l	Utah	250,000	1	207,500	Mar. '10	0.04
Vindicator Con., g	Colo	1,500,000	1	3,217,000	July '15	0.03
Wasp No. 2, g	S. D	500,000	1	484,466	Aug. '15	0.01
Wellington Mines, g	Colo	10,000,000	1	450,000	Aug. '15	0.00½
Wolverine, c	Mich	60,000	25	8,220,000	Mar. '15	4.00
Yak, s.l	Colo	1,000,000	1	1,907,685	June '14	0.03
Yankee Con., g.s	Utah	1,000,000	1	167,500	Jan. '13	0.01
Yellow Aster, g	Cal	100,000	10	1,163,789	May '15	0.02
Yellow Pine, l.z.s	Nev	1,000,000	1	583,008	Aug. '15	0.05
Yukon Gold, g	Alas	3,500,000	5	7,087,500	June '15	0.07½

Iron, Industrial and Holding Companies

Amalgamated, c	Mont	1,538,879	$100	103,495,183	Aug. '15	$0.50
Am. Sm. & Ref., com	U. S.	500,000	100	28,333,333	June '15	1.00
Am. Sm. & Ref., pf	U. S.	500,000	100	52,208,333	June '15	1.75
Am. Smelters, pf. A	U. S.	170,000	100	10,274,800	July '15	1.50
Am. Smelters, pf. B	U. S.	300,000	100	15,125,000	July '15	1.25
Greene Cananea	U. S.	450,642	100	4,371,646	June '14	1.00
Guggenheim Expl	U. S.	831,732	25	22,489,595	July '15	1.00
Inter'l Nickel, com	U. S.	380,315	100	17,704,109	June '15	5.00
Inter'l Nickel, pfd	U. S.	89,126	100	8,525,869	Aug. '15	1.50
National Lead, com	N. Y.	206,554	100	8,735,716	June '15	0.75
National Lead, pf	N. Y.	243,676	100	30,119,526	June '15	1.75
Old Dominion, c	Ariz	293,245	25	6,393,744	June '15	1.00
Phelps, Dodge & Co	U. S.	450,000	100	41,709,304	June '15	5.50
U. S. Steel Corp., com	U. S.	5,083,025	100	222,360,438	Dec. '14	0.50
U. S. Steel Corp., pf	U. S.	3,602,811	100	383,208,093	Aug. '15	1.75
U. S. S., R. & M., com	U.S.-Mex.	351,114	50	6,362,188	July '14	0.75
U. S. S., R. & M., pf	U.S.-Mex.	486,348	50	15,944,131	July '15	0.87½

Canadian, Mexican and Central American Companies

Ajuchitlan, g.s	Mex	50,000	$ 5	$ 212,500	Oct. '12	$0.25
Amparo, g.s	Mex	2,000,000	1	1,580,884	Feb. '15	0.03
B. C. Copper	B. C.	591,709	5	615,198	Jan. '13	0.15
Beaver Con., s	Ont	1,996,490	1	529,857	Apr. '15	0.03
Buffalo, s	Ont	1,000,000	1	2,757,000	July '14	0.03
Canadian Goldfields, g	B. C.	600,000	0.10	290,000	July '14	0.001½
Chontalpan, g.s.l.z	Mex	7,000	25	59,500	May '14	0.75
Cobalt Townsite, s	Ont	45,000	1	1,042,259	May '14	0.10
Coniagas, s	Ont	800,000	5	7,720,000	Aug. '15	0.30
Con. M. & S. Co. of Can	B. C.	58,052	100	2,058,907	July '15	2.00
Crown Reserve, s	Ont	1,768,814	1	6,067,030	July '15	0.02
Crow's Nest Pass C. Co.	B. C.	248,506	25	2,182,864	Mar. '11	0.25
Dos Estrellas, g.s	Mex	300,000	0.50	10,335,000	Dec. '13	1.50
El Oro, g.s	Mex	1,147,500	4.85	8,668,418	July '13	0.24
Esperanza, s.l.c	Mex	455,000	4.85	13,327,999	July '15	0.24
Granby, s.l.c	B.C.	148,496	100	5,756,178	Aug. '14	1.50
Greene Con., c	Mex	1,000,000	10	9,544,400	May '14	0.50
Guanajuato D., pf., s	Mex	10,000	1000	274,356	Jan. '11	3.00
Hedley Gold	B. C.	120,000	10	1,644,000	June '15	0.50
Hollinger, g	Ont	600,000	5	3,693,000	Sept. '15	0.20
Kerr Lake s	Ont	600,000	5	5,670,000	Mar. '15	0.25
La Rose Con., s	Ont	1,498,627	5	5,387,122	July '15	0.25
Le Roi No. 2, g	B. C.	120,000	24.30	1,501,740	May '15	0.24
Lucky Tiger Com., g	Mex	715,337	10	3,198,720	Aug. '15	0.09
McK.-Dar. Sav. s	Ont	2,247,692	1	4,540,333	July '15	0.03
Mines Co. of Am. (new)	Mex	1,700,000	10	1,215,000	July '13	0.12½
N. Y. & Hond. Ros., g	C. A.	2?0,000	10	3,730,000	July '15	0.30
Nipissing, s	Ont	1,200,000	5	13,290,000	July '15	0.25
Peñoles, s.l.g	Mex	80,000	25	6,361,688	June '13	1.25
Pinguico, pf., s	Mex	20,000	100	840,000	Oct. '13	3.00
Right of Way Mns, s	Ont	1,685,500	1	219,115	Nov. '14	0.02
Rio Plata, s	Mex	374,518	5	345,745	Feb. '13	0.05
San Rafael, g.s	Mex	2,400	25	1,442,380	Jan. '14	0.50
San Toy, g.s	Mex	5,750,000	1	530,000	July '13	0.01
Sorpresa, g.s	Mex	19,200	20	3,979,240	Jan. '11	34.00
Stand'd Silver-Lead	B. C.	2,000,000	1	1,550,000	Sept. '14	0.02½
Temiskaming, s	Ont	2,500,000	1	1,384,155	Apr. '13	0.06
Tem. & Hud. Bay, s	Ont	7,761	1	1,940,250	Nov. '14	3.00
Trethewey, s	Ont	1,000,000	1	1,061,998	July '14	0.05
Wettlaufer-Lorrain, s	Ont	1,416,590	1	637,465	Oct. '13	0.05

Assessments

Company	Delinqe	Sale	Amt.
Bonanza Con., Utah	Sept. 15	Oct. 6	$0.015
Bullion, Ida	Aug. 30	Sept. 25	0.005
Cash Boy, Nev	Sept. 29	Oct. 30	0.01
Cedar Creek, Ida	Aug. 28	Sept. 29	0.005
Comet, Ida	Aug. 30	Sept. 30	0.0005
Con. Virginia, Nev	Sept. 28	Oct. 19	0.05
Copper Chief, Ida	Aug. 30	Sept. 25	0.005
Diam'field Black Butte, Nev.	Oct. 4	Nov. 4	0.01
Exchequer, Nev	Oct. 4	Oct. 25	0.02
Gethin Le Roy, Utah	Sept. 25	Oct. 13	0.01
Goldstrike M. & L., Utah	Oct. 1	Oct. 20	0.01
Great Bend, Nev	Sept. 10	Oct. 10	0.01
Hancock Cons., Mich	Sept. 1	.....	1.00
Hancock Cons., Mich	Jan. 3	.....	1.00
Happy Day, Ida	Aug. 26	Sept. 30	0.0025
Hector, Ida	Sept. 4	Oct. 4	0.005
Hennessy-Burns, Ida	Aug. 20	Sept. 24	0.005
Idaho Los Angeles, Ida	Sept. 3	Sept. 25	0.005
Idaho Montana, Ida	Sept. 3	Sept. 25	0.001
Idaho Nevada, Ida	Sept. 7	Oct. 1	0.002
Imperial, Ida	Aug. 31	Oct. 1	0.005
Keweenaw, Mich	Sept. 1	.....	1.00
Laclede, Ida	Sept. 3	Sept. 27	0.003
Lake Superior & West., Ariz.	.....	.....	0.02
LeRoy, Ida	Sept. 25	Oct. 25	0.002
Liquidator, Ida	Aug. 28	Sept. 28	0.003
Lucky-Calumet, Ida	Aug. 27	Sept. 27	0.005
MacNamara, Nev	Aug. 23	Sept. 13	0.02
Nevada Cooperative, Nev	Sept. 15	Oct. 15	0.01
Nevada-Douglas, Nev	Sept. 27	Oct. 20	0.10
New Arcadian, Mich	Dec. 1	.....	0.50
New Baltic, Mich	Jan. 15	.....	0.50
New Quincy, Utah	Sept. 2	Sept. 23	0.01
Northern Light, Ida	Nov. 2	Dec. 2	0.004
Old Veteran, Ida	Sept. 2	Sept. 30	0.002
Oom Paul, Ida	Aug. 28	Sept. 28	0.01
Oom Paul Con, Ida	Aug. 30	Oct. 4	0.01
Ophir, Nev	Oct. 12	Nov. 2	0.05
Phedora, Ida	Sept. 21	Oct. 21	0.0005
Phoenix, Mich	Sept. 1	.....	1.00
Phoenix, Mich	Jan. 1	.....	1.00
Revelator, Utah	Oct. 4	Oct. 25	0.00½
Royal, Ida	Sept. 1	Oct. 1	0.001
Sandstorm Kendall, Nev	Aug. 23	Sept. 27	0.01
Selma Utah	Sept. 8	Sept. 25	0.005
Snowshoe, Ida	Aug. 26	Sept. 27	0.005
Sunset Dev., Wash	Aug. 25	Sept. 18	0.002
Syndicate, Utah	Sept. 11	Oct. 2	0.001
Tonopah Bonanza, Nev	Sept. 13	Oct. 11	0.01
Tonopah Midway, Nev	Aug. 18	Sept. 18	0.01
White Caps, Nev	Aug. 14	Sept. 18	0.015

Stock Quotations

There were no sales at auction reported in either New York, Boston or Philadelphia during the week ended Sept. 15.

COLO. SPRINGS	Sept. 14	SALT LAKE	Sept. 14
Name of Comp.	Bid.	Name of Comp.	Bid.
Acacia	.02½	Beck Tunnel	.06
Cripple Cr'k Con.	.008	Black Jack	.05
C. K. & N.	.02	Colorado Mining	.09½
Doctor Jack Pot	.09½	Crown Point	.01
Elkton Con.	.25	Daly-Judge	6.75
El Paso	.76	Gold Chain	.15
Findlay	.02½	Grand Central	.54
Gold Dollar	‡.02	Iron Blossom	.67
Gold Sovereign	.03	Little Bell	‡.10
Golden Cycle	1.77	Lower Mammoth	.03½
Isabella	.15½	Mason Valley	1.50
Jack Pot	.06½	May Day	.16
Jennie Sample	‡.02	Opohongo	.00½
Jerry Johnson	.04½	Prince Con	.60
Lexington	.005	Seven Troughs	.01½
Mary McKinney	.35	Silver King Coal'n	3.37½
Pharmacist	.008	Silver King Con.	2.05
Portland	1.50	Sioux Con.	.01½
Raven B. H.	.02	Uncle Sam	.05½
Vindicator	1.55	Yankee	.24

TORONTO	Sept. 14		
Bailey	.03½	Dome Exten	.26
Coniagas	3.75	Foley O'Brien	.28
Peterson Lake	.18	Hollinger	25.00
Right of Way	.04	Imperial	.05½
Seneca Superior	‡.78	Jupiter	.10
Silver Queen	.01	McIntyre	.47
T. & Hudson Bay	20.00	Pearl Lake	‡.00½
Timiskaming	.32	Porcu. Crown	.70
Wettlaufer-Lor	.05	Preston E. D.	.05
Dome Mines	21.50	Rea	‡.09

SAN FRANCISCO	Sept. 14		
Comstock Stocks		Misc. Nev. & Cal.	
Alta	.06	Belmont	3.80
Andes	.07	Jim Butler	.77
Best & Belcher	.06	Lone Star	.04
Caledonia	.50	MacNamara	.02
Challenge Con.	.05	Midway	.10
Chollar	.03	Mont.-Tonopah	.30
Confidence	.16	North Star	.10
Con. Virginia	.10	Rescue Eula	.08
Gould & Curry	.03	West End Con.	.53
Hale & Norcross	.03	Atlanta	.28
Julia	‡.03	Booth	.45
Mexican	.37	C.O.D. Con	.04
Occidental	.79	Comb. Frac	.08
Ophir	.22	D'field Daisy	.03
Overman	.09	Jumbo Extension	1.42½
Potosi	.03	Pitts.-Silver Peak	‡.06
Savage	.06	Round Mountain	.41
Sierra Nevada	.20	Sandstorm Kendall	.12
Union Con	.34	Silver Pick	.07
Yellow Jacket	.13	Central Eureka	.10

N. Y. EXCH.	Sept. 14	BOSTON EXCH	Sept. 14
Name of Comp.	Clg.	Name of Comp.	Clg.
Am.Sm.&Ref.,com	81	Adventure	1½
Am. Sm. & Ref., pf.	106	Ahmeek	398
Am. Sm. Sec., pf. B.	81½	Alaska Gold M	33½
Anaconda	70½	Algomah	2⅜
Batopilas Min	1½	Allouez	54
Bethlehem Steel	349	Am. Zinc	52½
Bethlehem Steel, pf.	150	Ariz. Com., ctfs.	8⅜
Chino	44½	Bonanza	.35
Colo. Fuel & Iron	46⅜	Butte-Balaklava	3½
Crucible Steel	95½	Butte & Superior	66½
Federal M. & S., pf.	44	Calumet & Ariz.	62½
Great Nor., ore., ctf.	40½	Calumet & Hecla	545
Guggen. Exp.	64½	Centennial	17
Homestake	117	Cliff	‡.90
Inspiration Con.	34½	Copper Range	54½
Mex. Petroleum	84½	Daly West	2½
Miami Copper	26⅛	East Butte	12
Nat'l Lead, com.	63½	Franklin	9
National Lead, pf.	110	Granby	83
Nev. Consol.	14⅛	Hancock	16½
Ontario Min	3	Hedley	27
Quicksilver	2½	Helvetia	.33
Ray Con	22½	Indiana	5
Republic I&S, com.	43½	Island Cr'k, com.	47
Republic I&S, pf.	101½	Island Cr'k, pfd.	89
SlossSheffl'd, com	52	Isle Royale	27
Tennessee Copper	56	Keweenaw	2⅛
Utah Copper	66⅛	Lake	13
U. S. Steel, com.	75⅛	La Salle	5½
U. S. Steel, pf.	113½	Mass	10
		Mayflower	3½
N. Y. CURB	Sept. 14	Michigan	2½
Alask'a Juneau	12½	Mohawk	71½
Alta Con	.31	New Arcadian	9½
Beaver Con	.27	North Butte	29½
Big Four	.05	North Lake	1½
Blue Bell	.02	Ojibway	1½
Braden Copper	8½	Old Colony	3
Buffalo Mines	.50	Old Dominion	52½
Can. Cop. Corpn	⅛	Osceola	81½
Cashboy	.05	Quincy	81
Chambers Ferland	.12	Santa Fe	2⅛
Chile Cop.	18⅛	Shannon	7
Con. Ariz. Sm.	⅛	Shattuck-Ariz	24½
Con. Coppermines	2½	Superior	26½
Con. Nev.-Utah	1/16	Superior & Bost	2½
Dia. Black B.	.02	Tamarack	55½
Florence	.46	Trinity	3½
Goldfield Con.	1 1/16	Tuolumne	‡.45
Goldfield Merger	.19	U. S. Smelting	40½
Greene Cananea	38½	U. S. Smelt'g, pf.	45⅛
International Nickel	190	Utah Apex	3⅜
Kennecott Cop.	53⅞	Utah Con	12½
Kerr Lake	3½	Victoria	2½
La Rose	1/16	Winona	3
Magma	15⅛	Wolverine	58
McKinley-Dar-Sa	.25	Wyandot	1½
Mines of Am	‡2⅛		
Nevada Hills	.20	BOSTON CURB	Sept. 14
New Utah Bingham	3½	Alvarado	.60
Nipissing Mines	6⅛	Bingham Mines	7½
Oro	.06½	Boston Ely	.21
St. Joseph Lead	12⅛	Butte & Lon'n Dev.	.31
South Utah	.15	Calaveras	1⅛
Stand'd Oil of N.J.	448	Calumet-Corbin	.04
Standard S. L.	1 1/16	Chief Con	.92
Stewart	1 1/16	Cortez	.45
Success	.88	Crown Reserve	.35
Tonopah	5⅛	Davis-Daly	1½
Tonopah Ex.	2 1/16	Eagle & Blue Bell	1⅜
Tonopah Merger	.36	First Nat. Cop.	2⅜
Tribullion	⅜	Houghton Copper	2½
Tularosa	‡⅛	Iron Cap Cop., pf.	5
Yukon Gold	2½	Majestic	.45
		Mexican Metals	.20
LONDON	Aug. 29	Nevada-Douglas	.63
Alaska Tre'dwell	£6 17s 6d	New Baltic	2½
Burma Corp.	1 13 9	Ohio Copper	.10
Cam & Motor	0 12 0	Oneco	.99
Camp Bird	0 5 3	Raven Copper	.12
El Oro	0 7 3	Rex Cons	.52
Esperanza	0 7 3	Smokey Dev	.15
Mexico Mines	3 11 3	So. Lake	5½
Nechi, pfd.	0 12 3	Tonopah Victor	.27
Oroville	0 14 9	Trethewey	.12
Santa Gert'dis	0 7 6	United Verde Ext.	6
Tomboy	1 0 3		
Tough Oakes	0 6 6	‡Last Quotations.	

Monthly Average Prices of Metals

SILVER

Month	New York			London		
	1913	1914	1915	1913	1914	1915
January	62.938	57.572	48.855	28.983	26.553	22.731
February	61.642	57.506	48.477	28.357	26.573	22.753
March	57.870	58.067	50.241	26.669	26.788	23.708
April	59.490	58.519	50.250	27.416	26.958	23.709
May	60.361	58.175	49.915	27.825	26.704	23.570
June	58.990	56.471	49.034	27.199	25.948	23.267
July	58.721	54.678	47.519	27.074	25.219	22.597
August	59.293	54.344	47.163	27.335	25.979	22.780
September	60.640	53.290	.....	27.986	24.260	.....
October	60.793	50.654	.....	28.083	23.199	.....
November	58.995	49.082	.....	27.263	22.703	.....
December	57.760	49.375	.....	26.720	22.900	.....
Year	59.791	54.811	.....	27.576	25.314	.....

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

COPPER

Month	New York Electrolytic		London Standard		London Best Selected	
	1914	1915	1914	1915	1914	1915
January	14.223	13.641	64.304	60.756	69.488	65.719
February	14.491	14.394	65.259	63.494	70.188	*
March	14.131	14.787	64.276	66.152	69.170	*
April	14.211	16.811	64.747	75.069	69.313	*
May	13.998	18.506	63.182	77.600	67.786	*
June	13.603	19.477	61.336	82.574	66.274	95.333
July	13.223	18.796	60.540	76.011	64.955	91.409
August	*	16.941	‡	68.673	‡	82.333
September	*	.....	‡	.....	‡	.....
October	*	.....	‡	.....	‡	.....
November	11.739	.....	53.227	.....	*	.....
December	12.801	.....	56.841	.....	*	.....
Year	.....	.....	.....	.....	.....	.....

TIN

Month	New York		London	
	1914	1915	1914	1915
January	37.779	34.260	171.905	156.550
February	39.830	37.415	181.556	176.925
March	38.038	48.426	173.619	180.141
April	36.154	47.884	163.963	166.225
May	33.360	38.790	150.702	162.675
June	30.577	40.288	138.321	167.636
July	31.707	37.423	142.517	167.080
August	*	34.389	‡	151.440
September	32.675	.....	‡	.....
October	30.284	.....	‡	.....
November	33.304	.....	139.391	.....
December	33.601	.....	147.102	.....
Av. year	34.301	.....	.....	.....

LEAD

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	4.111	3.729	4.011	3.548	19.665	18.606
February	4.048	3.827	3.937	3.718	19.606	19.122
March	3.970	4.053	3.850	3.997	19.651	21.883
April	3.810	4.221	3.688	4.142	18.225	21.094
May	3.900	4.274	3.808	4.182	18.503	20.347
June	3.900	5.932	3.810	5.836	19.411	25.170
July	3.891	5.659	3.738	5.531	19.051	24.611
August	3.875	4.656	3.715	4.520	‡	21.946
September	3.828	.....	3.658	.....	‡	.....
October	3.528	.....	3.384	.....	‡	.....
November	3.683	.....	3.585	.....	18.500	.....
December	3.800	.....	3.662	.....	19.097	.....
Year	3.862	.....	3.737	.....	.....	.....

SPELTER

Month	New York		St. Louis		London	
	1914	1915	1914	1915	1914	1915
January	5.262	6.386	5.112	6.211	21.533	30.844
February	5.377	8.436	5.228	8.255	21.413	39.819
March	5.250	8.541	5.100	8.366	21.460	44.141
April	5.113	10.012	4.963	9.837	21.569	49.888
May	5.074	14.781	4.924	14.610	21.393	68.100
June	5.000	21.208	4.850	21.038	21.345	100.614
July	4.920	19.026	4.770	18.856	21.568	97.250
August	5.568	12.781	5.418	12.611	‡	67.786
September	5.380	.....	5.230	.....	‡	.....
October	4.909	.....	4.750	.....	‡	.....
November	5.112	.....	4.962	.....	25.016	.....
December	5.592	.....	5.430	.....	27.369	.....
Year	5.213	.....	5.061	.....	.....	.....

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton. * Not reported, ‡ London Exchange closed.

PIG IRON IN PITTSBURGH

Month	Bessemer		Basic		No. 2 Foundry	
	1914	1915	1914	1915	1914	1915
January	$14.94	$14.59	$13.23	$13.45	$13.99	$13.90
February	15.06	14.55	14.12	13.45	14.08	13.90
March	15.07	14.55	13.94	13.45	14.10	13.95
April	14.90	14.55	13.90	13.45	14.13	13.95
May	14.90	14.61	13.90	13.60	14.27	13.83
June	14.90	14.70	13.90	13.67	13.96	13.77
July	14.90	14.94	13.90	13.91	13.90	13.68
August	14.90	16.01	13.90	15.31	14.08	14.75
September	14.90	.....	13.90	.....	14.03	.....
October	14.84	.....	13.75	.....	13.97	.....
November	14.59	.....	13.43	.....	13.83	.....
December	14.70	.....	13.45	.....	13.83	.....
Year	$14.88	.....	$13.78	.....	$14.01	.....